



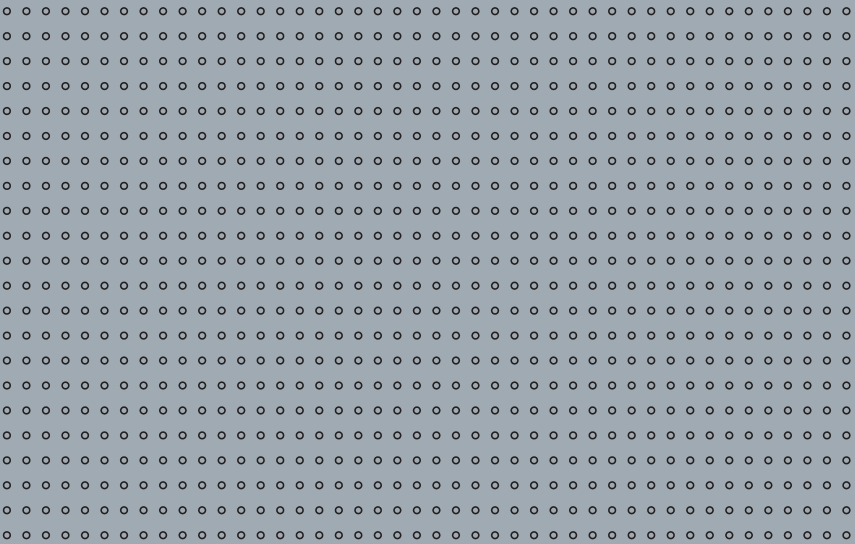
Master the Elements

# Operator manual

Simrad AP28  
Autopilot

English

Sw.1.3





# Operator manual

## Simrad AP28 Autopilot

English

Sw.1.3

Document no: 20222527

Revision: C

Date: January 2010

The original language for this document is English. In the event of any discrepancy between translated versions and the English version of this document, the English document will be the official version.

To the best of our knowledge, the content in this publication was correct at the time of printing.

As we are continuously improving our products we retain the right to make changes to the product and the documentation at any time. Updated manuals are available from our website [www.simrad-yachting.com](http://www.simrad-yachting.com), and are free to download.

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## About this manual

Rev. A	28.11.07	First issue
Rev. B	25.03.08	Follow up steering included. Updated according to autopilot software 1.2.
Rev. C	06.01.10	Updated according to autopilot software 1.3.

This manual is intended as a reference guide for operating and maintaining the Simrad AP28 autopilot.

An autopilot is a complex control system so please take time to read this manual to get a thorough understanding of the operation, the system components and their relationship to a complete AP28 autopilot system.

In this manual, names of menu commands, dialog box text and keys are written in boldface (e.g. **Main** menu, **Setup** command, **Left** key).

Important text that requires special attention from the reader is emphasized as follows:



*Used to draw the reader's attention to a comment or some important information.*



***Used when it is necessary to warn personnel that a risk of damage to the equipment or hazard exists if care is not exercised.***

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# 1 Operation



***An autopilot is a very useful navigational aid, but DOES NOT under any circumstances replace a human navigator***

Do not use automatic steering when:

- In heavy traffic areas or in narrow waters
- In poor visibility or extreme sea conditions
- When in areas where use of autopilot is prohibited by law













When using an autopilot:

- Do not leave the helm unattended
- Do not place any magnetic material or equipment near heading sensor used in the autopilot system
- Verify at regular intervals course and position of vessel
- Always switch to Standby mode and reduce speed in due time to avoid hazardous situations



## 1.1 Overview



Figure 1-1 AP28 Front Panel

Key	Description
	<b>Power ON-OFF / Light key</b>
	<b>Standby key</b> Engage Standby mode
	<b>Auto key</b> Engage Auto mode
	<b>NoDrift key</b> Engage NoDrift mode
	<b>Nav key</b> Engage NAV mode
	<b>Wind key</b> Engage Wind mode
	<b>Turn key</b> Enter turn sub-menu Tack or gybe in Wind mode
	<b>Menu/Enter key</b> Enter Main Menu Enter value, Confirm, OK Action according to the softkey symbol
	<b>Left key</b> Back, Left, Cancel, Exit <i>Long press:</i> Return to Main page (operation level 1) Action according to the softkey symbol
	<b>Right key</b> Next, Right Action according to the softkey symbol
	<b>Up key</b> Up in menu or list box, Increase Action according to the softkey symbol
	<b>Down key</b> Down in menu or list box, Decrease Action according to the softkey symbol


















	<b>Port key</b> Adjust the commanded course or wind angle 1 or 10 degrees Enable port power steering Action according to the softkey symbol
	<b>Starboard key</b> Adjust the commanded course or wind angle 1 or 10 degrees Enable starboard power steering Action according to the softkey symbol

## Softkeys






When the basic operation of the keys is changed, softkey symbols will be displayed right above the keys to indicate the alternate function.

The following softkey symbols are used:

Symbol	Action	Symbol	Action	Symbol	Action
	Ok		Up Increase		Day backlighting
	Cancel		Down Decrease		Shallow to stbd
	Back		Increase		Shallow to port
	Next		Decrease		Installation
	Reset trip log		Night backlighting		Present information

## Symbols

	Inactive unit, disabled data page
	Alarm reminder
	Locked

## Operational modes

The AP28 system is capable of the following primary steering modes: STBY (power steering), AUTO, NoDrift, NAV, WIND and WIND<sub>NAV</sub>. Each mode except WIND<sub>NAV</sub> have a dedicated key.

The WIND<sub>NAV</sub> mode can only be entered when in WIND mode.

Each mode provides you with a multifunction mode display.

User adjustable settings are found in the AP28 Main Menu (page 45).

## Alarms

Alarms are presented in plain text to alert you of system and external data failure conditions. Alarms are both audible and visual. The alarm listing is on page 105.

## Transfer of command

In a multistation system the command can easily be transferred from one unit to another by pressing any mode key. However, you can make a direct course change on an inactive unit. Pressing Port/Stbd key or turning the course knob on an inactive unit makes it active.

AP28 units not in control will display the  icon.

## Advanced operation

Refer to the Setup item in the Main Menu page 48 for information.

## 1.2 ON/OFF




*At first time turn on see page 63.*

A single press on the **PWR** key turns the autopilot system on and presents the start-up pages.



- Product name
- Serial number
- Software version
- Release date

Software version and release date are examples only.

After approximately 5 seconds, the system is operative and the unit that was turned on will show the Standby mode display. Other units in a multistation system will display . Control is transferred to any single unit by pressing its **STBY** key.

A long press on the **PWR** key activates the power down dialog box and the autopilot goes to STBY mode before it is turned off after 3 seconds.



*In an emergency it is possible, on a multistation system, to turn OFF the system at any control unit by pressing the **PWR** key.*



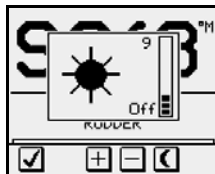
*Please note that even if the autopilot is turned off, a small amount of current is drawn from the batteries unless you throw the circuit breaker.*

## 1.3 Backlighting

The display backlighting may be adjusted at any time.



- 1 Press the **PWR** key



- The Light level overlay window will be displayed on top of the current view

- 2 Press one of the keys as described below to change the display backlighting:



- a The **PWR** key to increase the light level by one step



- b The **Up/Down** softkeys to increase/decrease the light level by one step



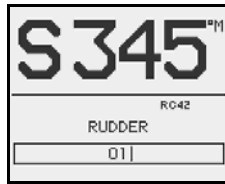
- c The **Day/Night** softkey to toggle between day and night profiles

If no adjustment is performed within 3 seconds, the Light level overlay window will close.

For contrast and day/night settings, refer to page 54.

## 1.4 Standby mode

STBY mode is the mode that is used when steering the boat at the helm.



Display information:

- Standby mode
- Current heading 345°M
- Compass source: RC42
- Rudder angle 01° to stbd.

See page 74 about VRF.

## Power steering (NFU)

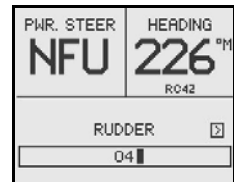
In Standby mode, press any of the **PORT** or **STBD** keys. The Non Follow-up (NFU) display is presented and the rudder will move as long as the key is pressed.




Activates PORT  
rudder command



Activates STBD  
rudder command



*When a NFU steering lever or remote control is operated, other control units show  (inactive). Refer to section 7 for operation of NFU steering levers or remote controls.*

## Follow-Up steering (FU)

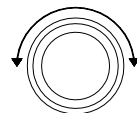
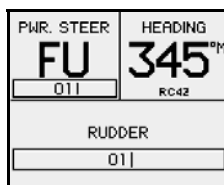


*Not applicable for Virtual feedback configuration (page 74).*

In the Follow-Up steering mode the course knob may be used to set rudder commands. The commanded rudder angle is shown on the display and the rudder will move to the commanded angle and stop.



Press both buttons simultaneously to activate Follow-Up



Use course knob to command rudder angle



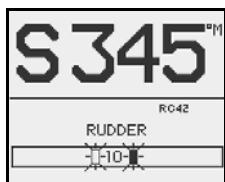
***While in Follow-up mode you cannot take manual control of the wheel.***



Return to manual control in Standby by pressing the **STBY** button.

## Alternative displays in Standby mode

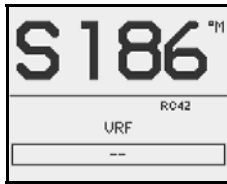
### *Alternating rudder angle bargraph*



*If your autopilot is driving a Simrad MSD50 Stern Drive, the rudder angle display will after turn-on alternate between 10 degrees port and starboard to indicate that the (rudder) zero point need be set.*

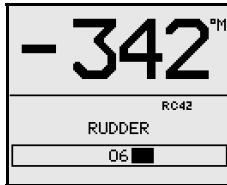
Refer to page 112 to set the zero point.

### *No rudder angle bargraph*



When the autopilot is operating on Virtual Rudder Feedback (VRF), the rudder angle bargraph is empty in Standby mode.

### *No mode indication*



When the autopilot is configured for Electronic Vessel Control (EVC), you can take manual control of the steering by means of the helm irrespective of the autopilot mode. The autopilot will go to Standby mode. The "S" in the display is replaced by a dash to indicate that steering is from the helm. Ref. page 115.

## 1.5 Automatic steering

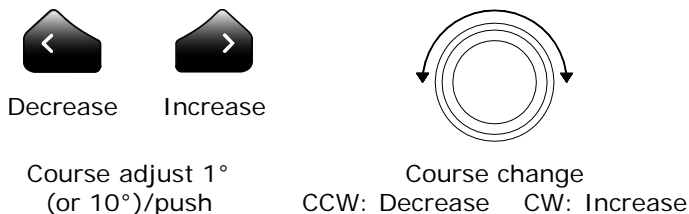
### AUTO (Compass) mode

When the **AUTO** key is pressed, the AP28 automatically selects the current boat heading as the set course and maintains the rudder angle. This gives a bumpless transfer at the mode change.



- **Automatic steering mode**
- Set course: 340 degrees
- Compass reading: 339°M
- Heading source: RC42
- Rudder angle: 01° to starboard
- Speed: 12.8 kn (from log)
- Steering parameter set: LO-A (Low automatic)

The AP28 will keep the boat on the set course until a new mode is selected or a new course is set with the course knob or the PORT or STBD keys. One revolution of the course knob equals a 45° course change.

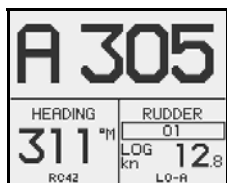


*On power boats you may in the Setup menu preset the keys to change course by 10° per press (see page 60)*

Once the course is changed to a new set course, the boat will automatically turn to the new heading and maintain the new course.

## Heading capture

When in AUTO or NoDrift mode (page 30) heading capture allows you to automatically cancel the turn you are in by an instant press on the **AUTO** key or the **NoDrift** key. The autopilot will cancel the turn to continue on the heading read from the compass the very moment you pressed the **AUTO** key or the **NoDrift** key. This is a useful feature if you are not sure of the exact turn you have to make to hit e.g. an inlet or a dock.



- **Automatic steering mode**
- New "captured" heading: 305°
- Compass reading: 311° M (magnetic) or T (true)



Regain manual steering by pressing the **STBY** key.

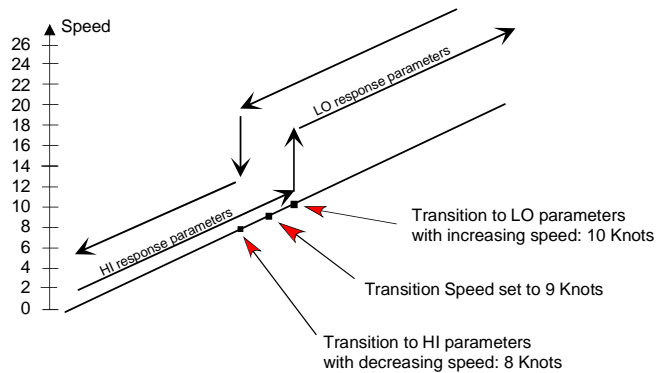
## Control of steering performance

When operating in an automatic mode the AP28 utilizes two different sets of steering parameters (HI/LO). The

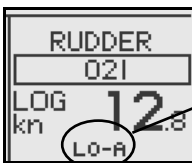
parameters control the response of the boat at different speeds or wind directions. The two parameter sets can be automatically or manually selected, and each set can be manually adjusted (response adjust).

The speed at which the autopilot automatically changes from LO to HI parameters (or opposite) is determined by the "Transition HI-LO" set in the *Installation/Commissioning/Seatrial* menu, page 83. See diagram on next page.

At no speed input the autopilot defaults to LO steering parameters when engaging an automatic mode from STBY. This is a safety feature to prevent oversteering.



#### Display legend



- HI-A High response parameters set automatically
- LO-A Low response parameters set automatically
- HI-M High response parameters set manually
- LO-M Low response parameter set manually

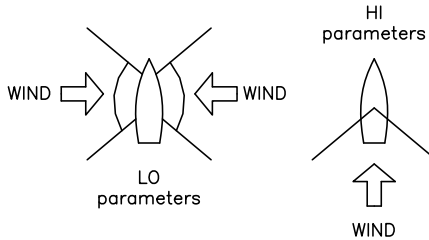
#### Power boats

On power boats the automatic selection of HI or LO is determined solely by the speed of the boat as shown in the diagram above.

#### Sailboats

When sailing in WIND mode, the parameter set is determined by the speed of the boat and the direction of the wind as per below.





So if you loose too much speed e.g. when tacking, the parameters will change to HI to gain sufficient rudder response. This should be observed when setting the transition speed on sailboats. See also ***Wind response*** on page 16.

## Response adjust

The Autotune function in the AP28 is so refined that the majority of boats will need no further adjustments of the steering parameters. On some boats, however, or at particular sea conditions a fine tuning of the steering parameters may improve the performance of the autopilot.

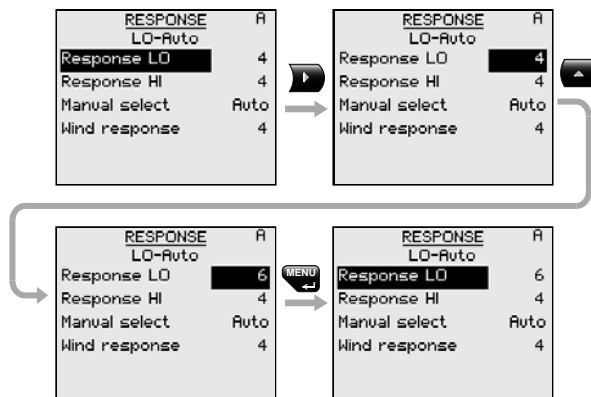
The Response control allows you to make this fine tuning for each of the two (HI/LO) parameter sets. The response can be set to nine levels. Level 4 is default with parameter values as set by the Autotune function. If no Autotune is made (not recommended) the level 4 values are the factory default values.

A low response level reduces the rudder activity and provides a more "loose" steering.

A high response level increases the rudder activity and provides a more "tight" steering.

A too high response level will make the boat start S-ing.

When you access the RESPONSE page the highlighted *Response* parameter is the one that is active.



*Adjustment of HI and LO values can be performed even with the boat out of the water.*

Range	Change per step	Default
1-9	1	4

### ***Wind response (sailboats)***



*Verify that the difference between Course To Steer (CTS) and the actual heading is at an acceptable minimum.*

If the difference between the set wind angle and the actual wind angle is too big, increase the 'Wind response' to reduce the difference.

If the actual wind angle is S-ing around the set wind angle, or the rudder activity is too high, the 'Wind response' should be reduced.






The sub-headline in the display shows the active parameter set and how it is selected.

RESPONSE
HI-Manual

## Pattern steering (power boats)

The autopilot offers a number of different pattern steering features when in AUTO mode. There is a one minute time-out between selecting a turn pattern and starting the turn. During the time-out period the autopilot will maintain the set course.

When steering in a turn pattern you may at any time adjust the variables by pressing the  key.

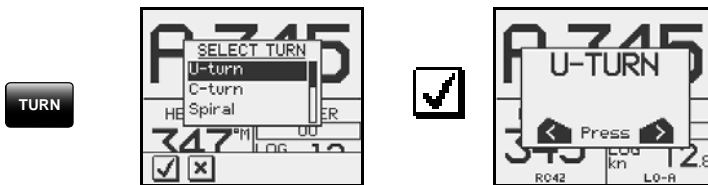


To exit a turn pattern simply press the **AUTO** key.

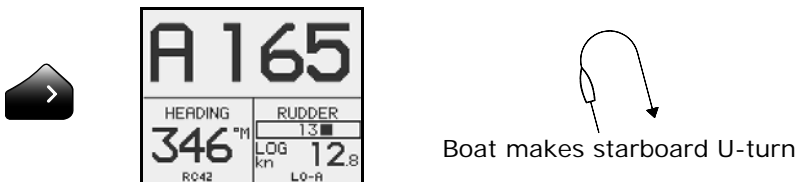
### U-Turn

U-Turn changes the current set course to be 180 degrees in the opposite direction.

This feature is very useful in a man overboard situation and whenever you want to steer back on a reciprocal heading.



Press either the  or  key to select the direction to make the U-Turn and start the turn.

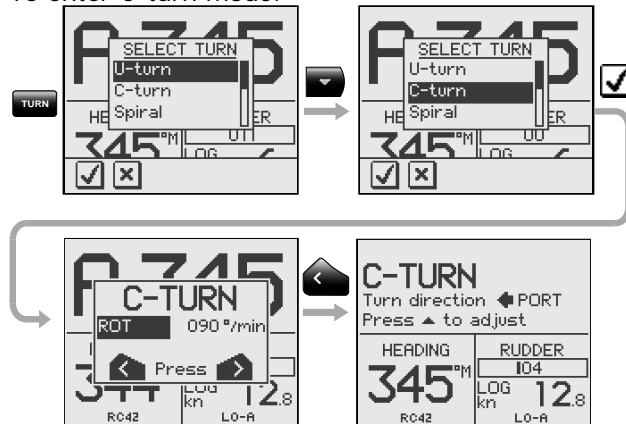


## C-turn

The autopilot provides a continuous turn feature when in AUTO mode. This may be used for circling fish or a particular object on the seabed.

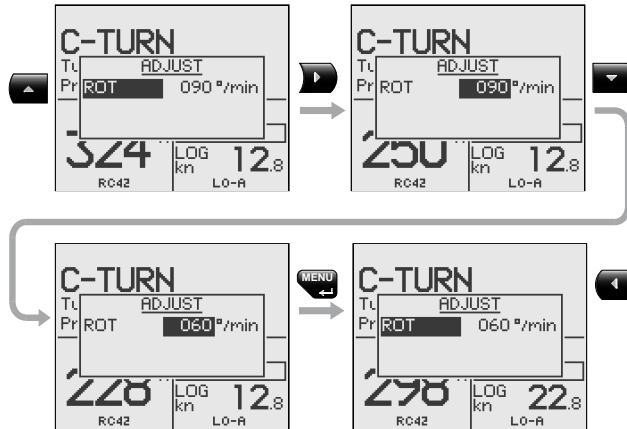
C-turn makes the boat turn in a circle with a constant rate of turn. The user decides whether the C-turn should be made to port or to starboard.

To enter C-turn mode:



Press the or key to select the direction in which to make the C-turn and start.

The turn rate (ROT) can be adjusted before the turn is initiated and during the turn. Increasing the turn rate yields to a smaller circle and vice versa.



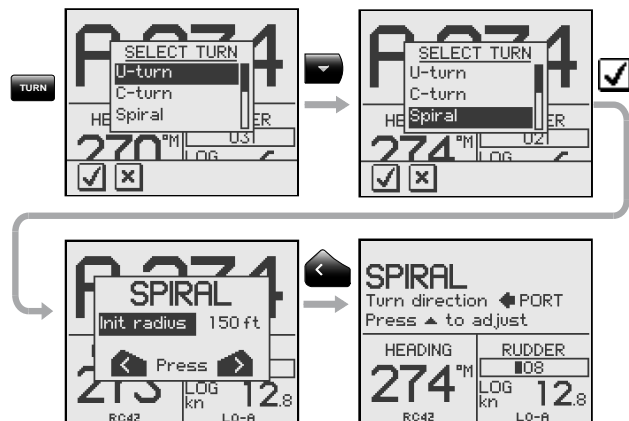
Turn parameter	Range	Change per step	Default	Units
Rate of turn	10 - 600	5	90	°/min

### *Spiral-turn*

The spiral-turn feature may also be used for circling fish or when searching a particular object on the seabed.

Spiral-turn makes the boat turn in a spiral with a decreasing or increasing radius.

To enter Spiral-turn mode:

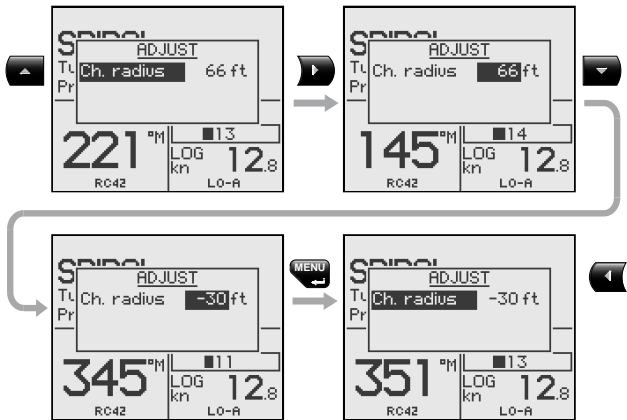


The “initial” radius can be set before the turn is started.

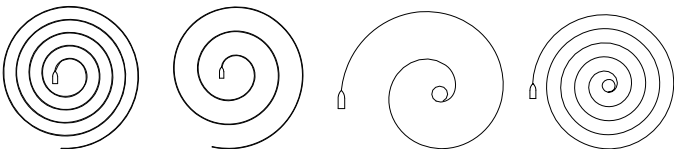
Press either the  or  key to select the direction in which to make the spiral-turn and start.

During the turn the “change in radius” can be adjusted and the number of feet or meter is how much the radius is changed for each circle turned.

If the “change radius” is set to zero, the boat will turn in a circle.



Negative values indicate decreasing radius while positive values indicate increasing radius.



Increasing radius

Decreasing radius

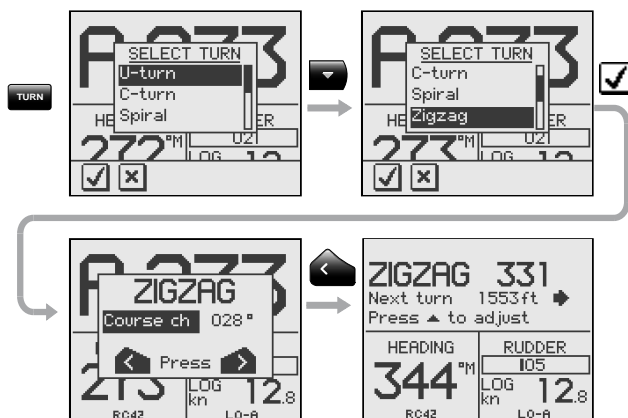
Turn parameter	Range	Change per step	Default
Initial radius	33 ft - 3281 ft	10	656 ft
	10 m - 1000 m	10	200 m
Change of radius per turn	-164 ft - +164 ft	5	66 ft
	-50 m - +50 m	2	20 m



*The unit for radius is the same as the unit set for depth (feet or meter).*

## Zigzag-turns

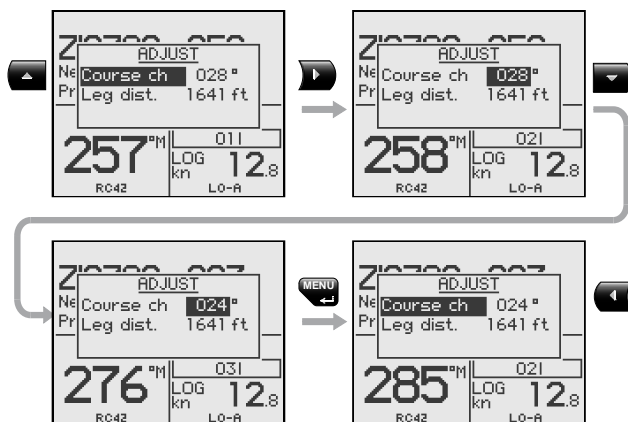
To enter zigzag-turn mode:



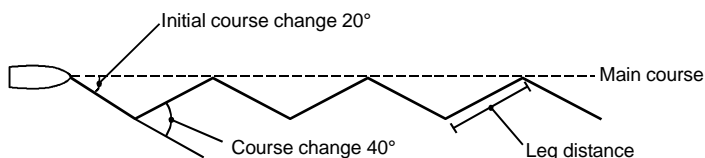
The course change can be set before the turn is initiated (2-70°).

Press either the or key to select the direction in which to make the first course change and start.

While sailing in a zigzag pattern you can alter the course change, leg distance, and the main course. An arrow shows the direction of the next course change.







Turn parameter	Range	Change per step	Default
Course change	4° - 140°	4	28°
Leg distance	82 ft - 9843 ft 25 m - 3000 m	50 25	1641 ft 500 m

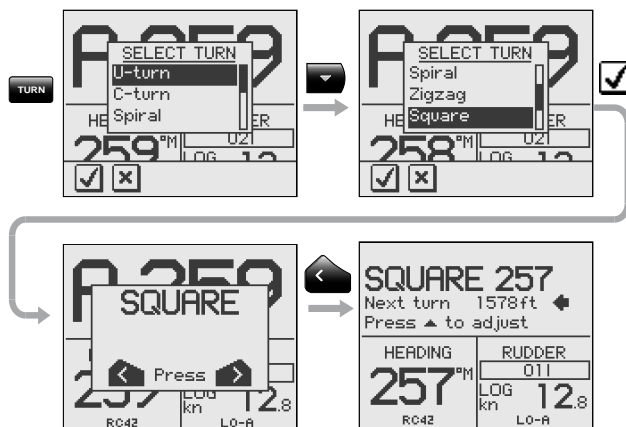


The unit for leg distance is the same as the unit set for depth (feet or meter).

### Square-turn

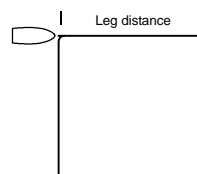
The square-turn feature in AUTO mode can also be made as rectangle or any pattern where the next turn is 90°.

To enter Square-turn mode:



Press either the or key to select the direction in which to make the first course change and start.

You can at any time change the main course.



You can also at any time change the distance of the leg until the boat makes a new 90° turn.



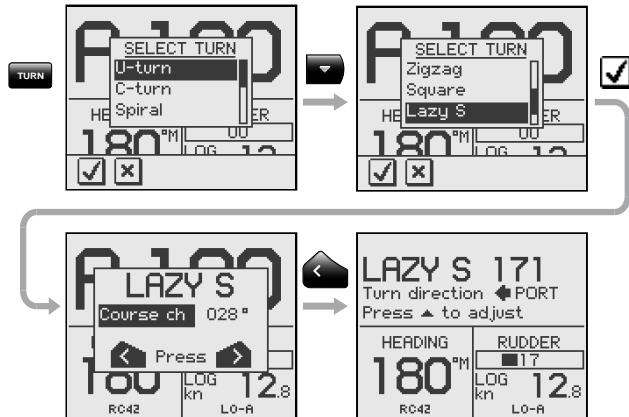
Turn parameter	Range	Change per step	Default
Leg distance	82 ft - 9843 ft	50	1641 ft
	25 m – 3000 m	25	500 m



*The unit for leg distance is the same as the unit set for depth (feet or meter).*

## Lazy S-turn

To enter Lazy S-turn mode:

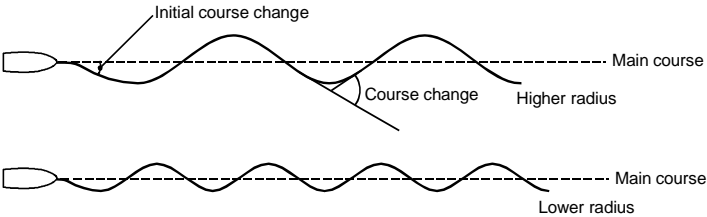
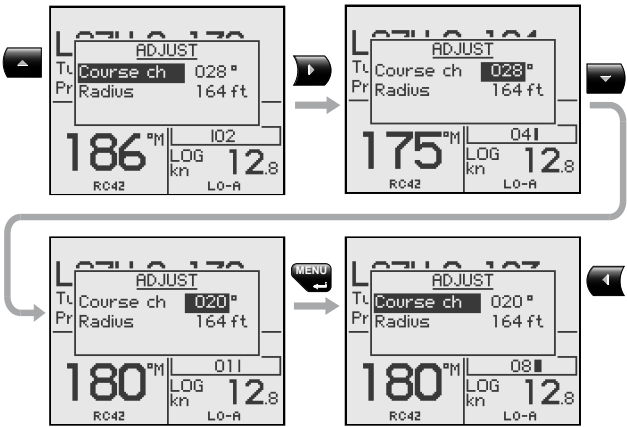


The course change can be adjusted before the turn is initiated (2-80°).

Press either the  or  key to select the direction in which to make the first course change and start.

While in a Lazy S pattern you can alter the course change magnitude, turn radius and the main (average) course. An arrow shows the direction of the turn.

Adjust course change and radius as follows:



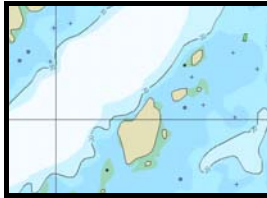
Turn parameter	Range	Change per step	Default
Course change	4° - 160°	4	28°
Radius	16 ft - 1641 ft 5 m - 500 m	10 5	656 ft 200 m



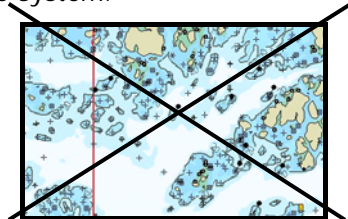
*The unit for radius is the same as the unit set for depth (feet or meter).*

## Depth Contour Tracking, DCT™

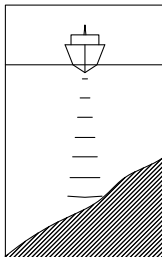
With input from an echo sounder, the autopilot can be set to steer the boat to a set depth. This is very useful if you want to follow a depth contour. Make sure you have depth reading available in the system.



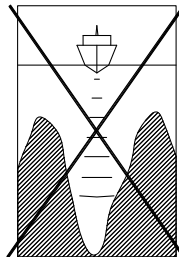
Smooth seabed



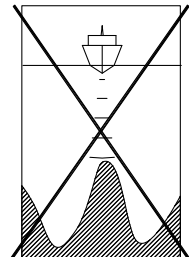
Rocky waters



Slope



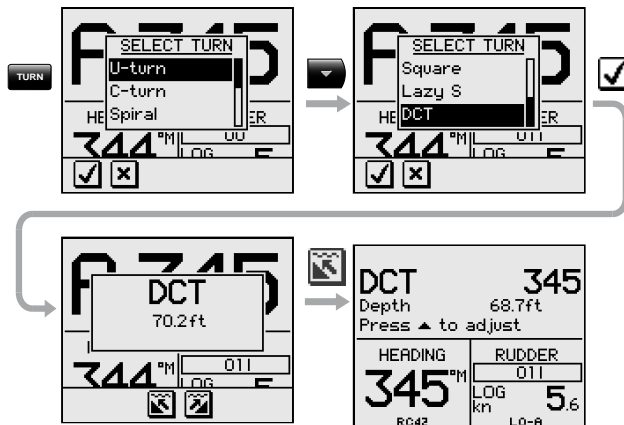
Narrow channel







Ridge



***Do not use this feature unless the seabed is suitable. Do not use it in rocky waters where the depth is varying significantly over a small area.***



The actual depth reading is shown on the display.

Steer the boat to the depth you want to track and in the direction of the depth contour (main course). When the wanted depth is shown in the display, activate the depth contour steering with the  or  softkey (any of the two). Use the  key when it is shallow to port or the  key when it is shallow to starboard.

## Main course

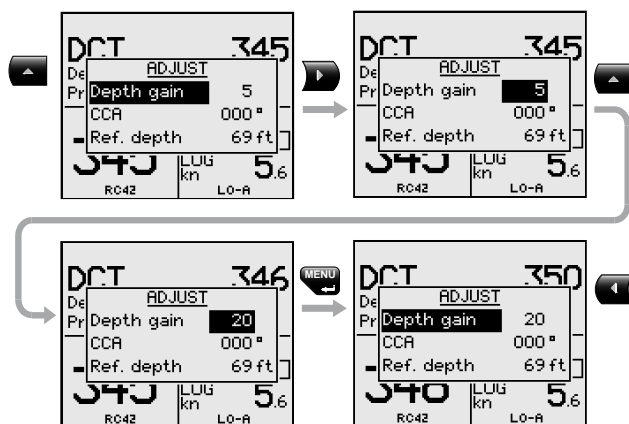
This should be the main (average) direction of the depth contour you want to follow. If the contour line is making a big change in direction, you should manually adjust the set course to the new direction. This will result in a quicker response from the autopilot. If the course is not adjusted, the autopilot will need more time to turn and steer the boat back to the reference depth.

The sub screen has the following adjustments:

## Depth gain

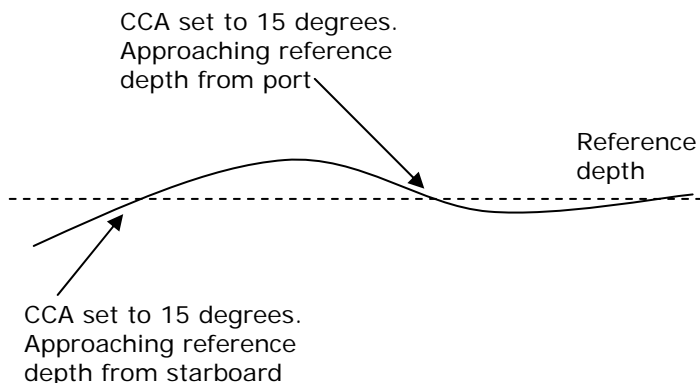
The autopilot is tracking the depth by computing an x-track error when the boat is off the reference depth. This error automatically adjusts the set course to bring the boat back on track.

Use the gain control to have a firm or smooth response to the variation in depth.



## Contour Cross Angle (CCA)

With this parameter you can make the boat lazy s across your reference depth. With the CCA set to zero there is no S-ing. The CCA is an angle that is added to or subtracted from the set course. Each time the boat crosses the reference depth, the sign (+/-) of the CCA is changed and makes the boat turn to cross the reference depth contour in the opposite direction. The larger the CCA the bigger the turn.



Turn parameter	Range	Change per step	Default
Main course	0° - 359°	1	–
Depth gain	5 - 95	5	5
Contour Cross Angle	0 - 50	1	0

## Reference depth

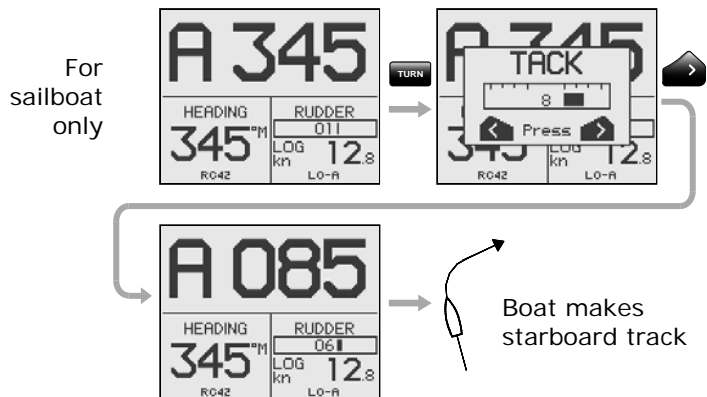
The reference depth is captured when the DCT™ is activated. To change the reference simply use the **Up** or **Down** key.

## Tacking in Auto mode (sailboat)

The tack function is only available when the system is set up for SAIL boat type in the installation setup.

Tacking in AUTO mode is different from tacking in WIND mode. In AUTO mode the tack angle is fixed and can be set in the **Setup/Sailing** menu. Default tack angle is 100°.

Tacking should only be performed into the wind and must be tried out in calm sea conditions with light wind to find out how it works on your boat. Due to a wide range of boat characteristics (from cruising to racing boats) the performance of the tack function may vary from boat to boat. Except for the fixed course change and the difference in displays, the procedure is similar to that of the U-Turn described on page 17.



## 1.6 NoDrift mode

The NoDrift mode is an alternative to route steering in NAV mode, and is automatically entered when you press the **NO-DRIFT** key.




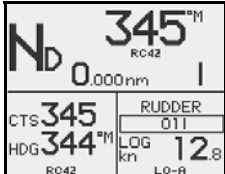
*The data source when operating in NoDrift mode is the Position (Pos) source. To operate in NoDrift mode your GPS/chart plotter must be turned on.*



Unlike when in Auto mode the autopilot will steer the course unaffected by wind and current when the NoDrift mode is engaged.

The course to steer to (bearing line) can be changed the same way as when changing course in Auto mode.






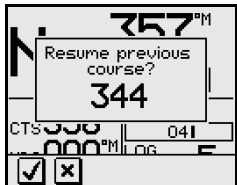
- Compass heading: 345° M
- Rudder Angle: 01 to starboard
- Speed: 12.8 kn from the log
- Steering parameter: LO-A

## Dodging (Resume previous bearing line)

The AP28 has no specific dodge key. When in NoDrift mode, simply press **STBY** and power steer or use the helm to pass any obstacle.

When you return to NoDrift mode within 60 seconds the following display is shown, offering two alternatives:





☒ Go back to NoDrift mode on previous set bearing line

☐ Go to NoDrift mode with current heading as set bearing line

If none of the two softkeys are pressed within 5 seconds, the dialog box will disappear and the autopilot will go to NoDrift mode with current heading as set bearing line.

If your dodging maneuver takes more than 60 seconds, the autopilot will remain in Standby mode.

## 1.7 Navigating with the AP28

The AP28 has the capability to use steering information from an external navigator (GPS, Chart Plotter) to direct the boat to a specific waypoint location, or through a route of waypoints. The information received from the navigator automatically changes the course to steer to

keep the boat on the track line and direct the AP28 to the destination waypoint.



*If the AP28 is connected to a navigation receiver that does not transmit a message with bearing to next waypoint, it will steer on Cross Track Error (XTE) only. In that case you have to revert to AUTO mode at each waypoint and manually change set course to equal bearing to next waypoint and then select NAV mode again.*

To obtain satisfactory navigation steering, the following points must be fulfilled prior to entering the NAV mode:

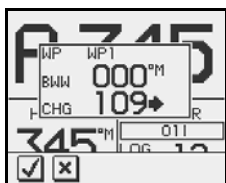
- The AP28 autosteering must be tested and determined satisfactory
- The navigation receiver (GPS, Chart Plotter) must be in full operating mode with adequate signal characteristics for valid position and navigation data
- At least one waypoint must be entered and selected as the current "Go to" waypoint



*The data source when operating in NAV mode is the Navigation (Nav) source. It is normally the same as the Position source (GPS/Chart plotter) see page 51.*

*Navigational steering should only be used in open waters. When selecting NAV mode, the AP28 maintains the current set course and prompts the user to accept the course change towards the destination waypoint.*

Press the **NAV** key to activate the NAV prompt display.



The prompt display shows the name of the next waypoint (WP), the bearing of the track line (BWW) from the previous waypoint to the destination waypoint, the required course change (CHG) and the direction in which the boat will turn.



*If only one waypoint has been entered the bearing will be from the present position to the destination waypoint.*



- NAV mode
- Course to steer (CTS): 005 is set internally by the autopilot to steer the boat onto the track line and maintain the bearing
- Cross Track Error (XTE): 1.315 nm

- Boat symbol illustrating whether the boat is to port or starboard of planned track
- Compass heading: 350° M
- Next waypoint: WP1
- Speed over ground (SOG): 12.8 kn
- Distance to next waypoint (DTW): 14.29 nm
- Steering parameter: LO-A

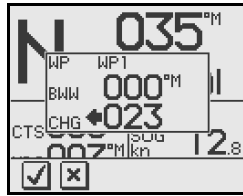


*For Cross Track Error, the number of decimals shown depends on the output from the GPS/chart plotter. Three decimals give a more accurate track keeping.*

When operating the AP28 in NAV mode to steer through a route of waypoints, the AP28 will steer to the nearest waypoint in the direction of the route after you accept the NAV mode prompt. When you arrive at the waypoint, the AP28 will output an audible warning, display an alert screen with the new course information, and automatically change course onto the new leg.




*If the required course change is more than the NAV change limit (default 10°), you have to verify that the upcoming course change is acceptable. This is a safety feature. See page 73 on how to change the 'NAV change limit'.*



Alert screen



Press the  softkey to verify course change larger than 10°.

If no verification is made, the AP28 will continue on the current set course in AUTO mode.

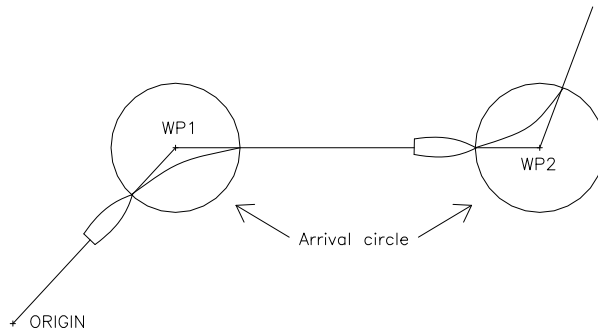


Regain manual steering by pressing the **STBY** key.

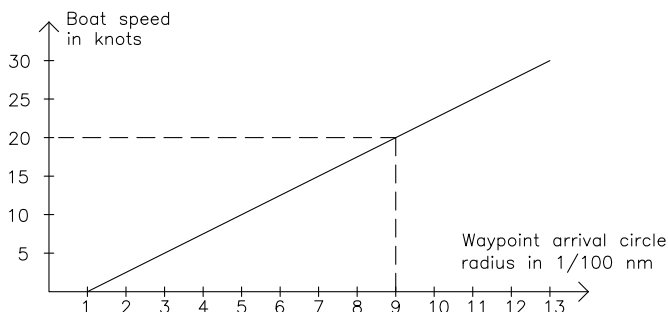
## Setting the waypoint arrival circle

For route navigation it is recommended to use automatic waypoint shift at a set waypoint arrival circle.

The arrival circle should be adjusted according to boat speed. The higher the speed, the wider the circle. The intention is to make the autopilot start the heading change in due time to make a smooth turn onto the next leg.



The figure below may be used to select the appropriate waypoint circle on the GPS/chart plotter.



Example: With the speed of 20 knots you should use a waypoint circle with radius 0.09 nm.



*The distance between any waypoints in a route must not be smaller than the radius of the waypoint arrival circle when using automatic waypoint shift.*

## Selecting a different navigation source

If you have more than one navigator connected to the AP28, you will be able to choose any for navigation. Refer to the 'Sources' item in the *Setup* menu for details on how to select a different navigator (page 53).

## 1.8 Wind vane steering (sailboats)

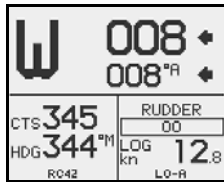


*The WIND mode is only available if the system has been set up for SAIL-boat in the Installation Menu.*

Prior to entering WIND mode the AP28 system should be operating in AUTO, with valid input from the wind transducer.

Enter the WIND mode by pressing the **WIND** key.

The wind display presents the following information:



- Wind (vane) mode
- Set wind angle: 008 degrees from starboard
- Measured wind angle: 008°A (apparent) or T (true)
- Course to steer (to maintain set wind angle): 345°

- Heading: 344° M (magnetic) or T (true)
- Rudder angle: 00°
- Speed from log: 12.8 kn
- Parameter: LO-A (Low value, automatic set)

The set course to steer (CTS) and set wind angle are entered from the compass heading and the wind transducer at the moment the WIND mode is selected. From that point the autopilot will change the course to maintain the wind angle as the wind direction may change.



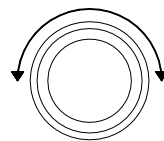
*If the cumulative shift of the wind direction exceeds a set limit a WIND SHIFT alarm will sound.*

Adjustments to the set wind angle is as per below.



Steer port    Steer stbd

Adjust set wind angle  
1° / push



Major wind angle adjust  
CCW: Steer port    CW: Steer stbd



Regain manual steering by pressing the **STBY** key.

## Tacking in Wind mode

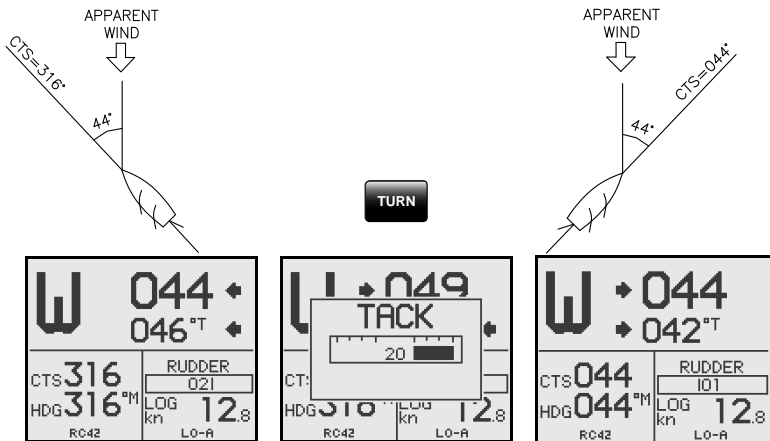
Tacking in WIND mode as compared to AUTO mode can be performed when sailing with apparent or true wind as the reference; the true wind angle should be less than 90 degrees.

The tacking operation will immediately mirror the set wind angle to the opposite side of the bow. A tack window will appear on the display. The rate of turn during the tack will be given by the '*Tack time*' parameter set in the *Setup/Sailing* menu (page 58). The tack time is also controlled by the speed of the boat to prevent loss of speed during a tack.

A quick press on the **TURN** key will activate the tack function and the boat will start turning to the opposite wind angle.

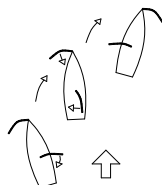
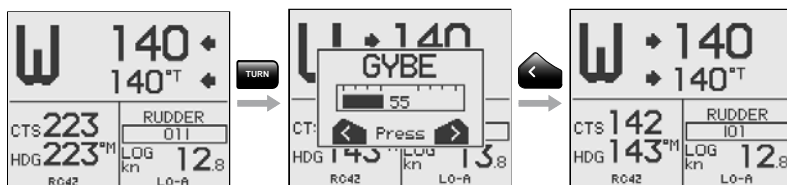


*A new press on the **TURN** key after the Tack window appears, will interrupt the tack operation and the boat will return to the previous set wind angle.*



## Gybing

Gybing is possible when the true wind angle is larger than  $120^\circ$ .



The time to make a gybe is determined by the speed of the boat to make it as quick as possible within control.

## Tack and gybe prevent

When beating and running, using the autopilot is most critical.

If the sails are unbalanced when beating, yaw forces from the sails can drive the boat into the wind. If the boat is driven beyond the set minimum wind angle (see page 90), the thrust from the sails will suddenly disappear and reduces the boat speed. Hence the boat will be more difficult to steer because the rudder will become less effective.

The tack prevent function in WIND mode has been implemented to avoid such situations. It will react immediately when the apparent wind angle becomes  $5^\circ$  less than the set minimum wind angle, and more rudder will be commanded.

When running, it is difficult to steer the boat with waves coming sideways or from behind. The waves may yaw the boat into an unwanted gybe; this can be hazardous for both the crew and the mast.

The gybe prevent function will be activated when the actual apparent wind angle becomes greater than  $175^\circ$  or




gets opposite to the set wind angle. More rudder will be commanded to prevent an unwanted gybe.



***The tack and gybe prevent functions are not a guarantee against getting into a hazardous situation. If the effect of the rudder and/or drive unit is not adequate, it may happen. Pay particular attention in such situations.***

## 1.9 Wind steering and navigation (sailboats)

The autopilot can also steer the boat given both wind data and track data from a GPS/chart plotter. In this mode called WIND<sub>NAV</sub> mode the automatic steering is based on a set of criteria (see below). Wind steering and navigation is activated by pressing the **NAV** key when in Wind mode [1]. The initial course change (CHG) needed to navigate towards the active waypoint, is calculated by the autopilot. The autopilot will utilize the current wind direction in these calculations and the change of course is accepted by pressing the  softkey [2].

## Operating in WIND<sub>NAV</sub> mode

Refer to Figure 1-2 which shows a scenario with a sailboat that enters Wind<sub>NAV</sub> mode to sail the most efficient way to waypoint WP1.

1. The autopilot is still in Wind mode approaching mark 2 and waypoint WP1 has been entered on the chart plotter.
2. The Wind<sub>NAV</sub> mode is entered and the autopilot prompts confirmation for a course change of 71 degrees to starboard.
3. The boat is now on the leg to mark 4 where a starboard tack is required to avoid running on ground. The distance to tack DTT is displayed and so is VMG to wind. Furthermore the autopilot displays course to steer and heading.
4. The tack has been initiated on the autopilot and the tack display is presented.
5. The autopilot now presents you with information about the new leg and the next tack.
6. You are about to cross the layline and the autopilot “recommends” a new tack to Port.
7. The new tack is performed.
8. You are on the last leg directly to the waypoint. The autopilot is now keeping the boat on track (XTE) and displays bearing and distance to the waypoint.

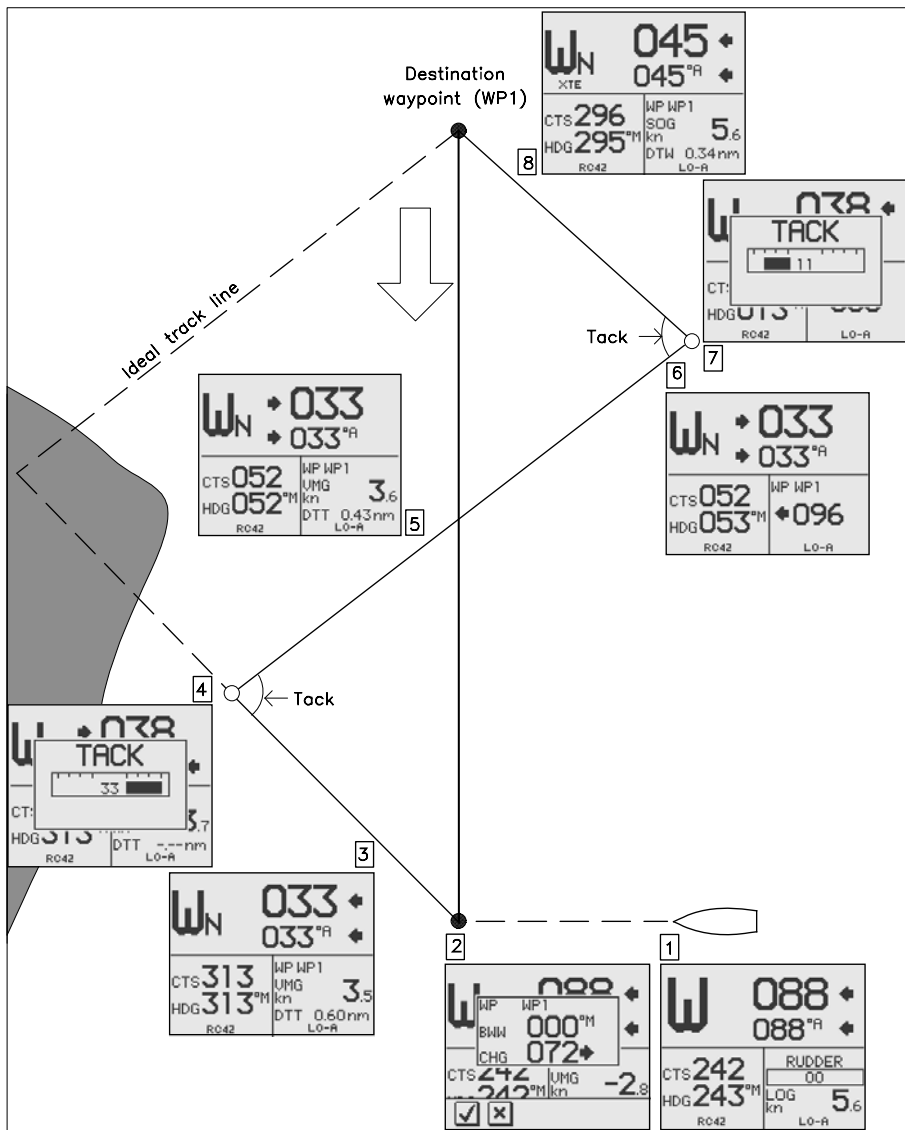


Figure 1-2

## 1.10 Data pages

A number of data pages can be displayed if the information is available on SimNet (see page 103).

When one of the main mode pages are displayed, access and scroll through the available data pages by pressing the **Up/Down** keys.

When accessing the data pages, the last active data page will be shown first.

If you prefer to change the number of instrument pages to be available; access the **Main menu/Data pages setup**.

When displaying data pages the left hand side of the screen will show the following information depending on mode:



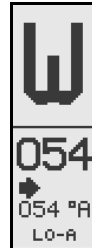
Standby mode  
Heading  
Heading source



Auto mode  
Set course  
Heading  
Heading source  
LO parameters,  
set automatically



Nav/NoDrift mode  
Course to steer  
Cross Track Error (XTE)  
LO parameters,  
set automatically

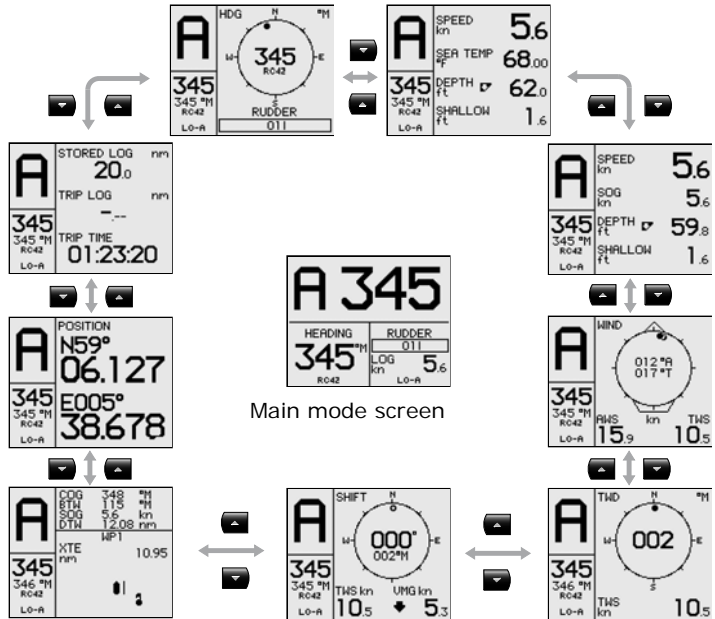


Wind mode  
Set wind angle  
Actual apparent wind angle  
LO parameters,  
set automatically



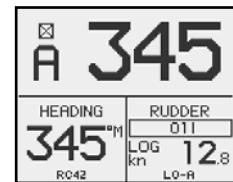
Wind<sub>NAV</sub> mode  
Layline steering  
Set wind angle  
Actual apparent wind angle  
LO parameters,  
set automatically

## Available data pages



## 1.11 Multiple station system

In normal operation control is accessible from every control unit connected to the AP28 system. One control unit is "active" and provides the user with access to all functions. All remaining control units are "inactive" and have no effect on course changes. A single press on any of the mode keys on an "inactive" control unit will allow transfer of command and make it "active".

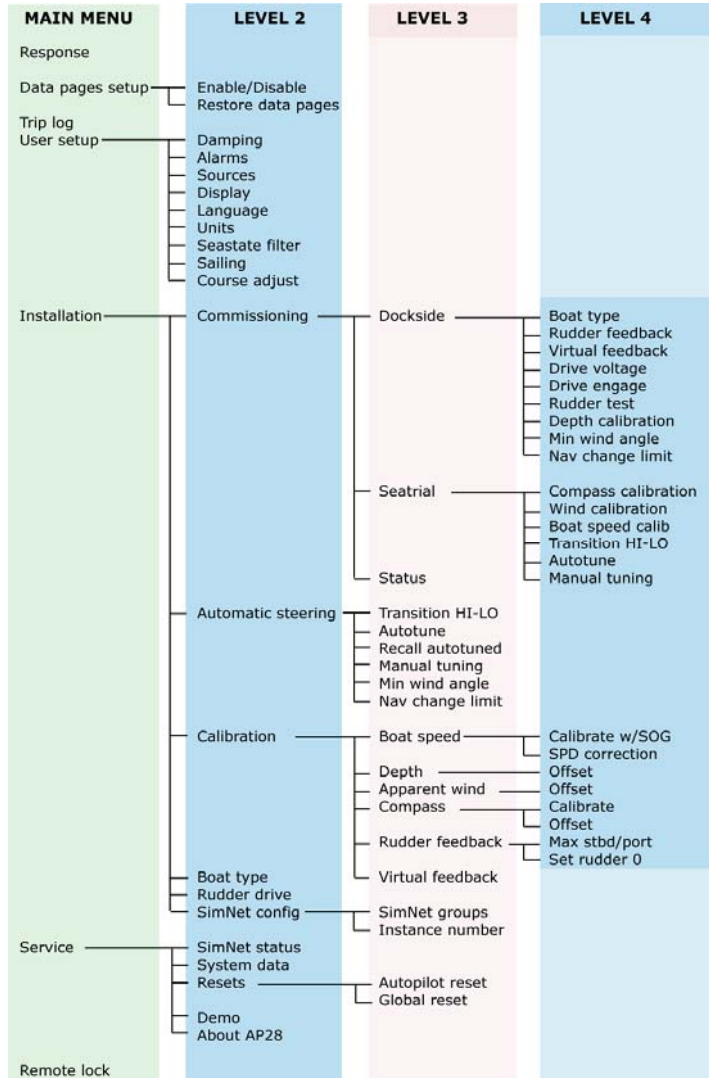


*Inactive unit*

***Blank page***

## 2 Main menu

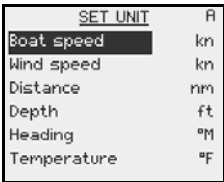
In the Main menu you will find items for operation, setup and installation of the autopilot. The Service menu item presents you with various system information and access to the Demo mode.



The main menu is activated by a press on the **MENU** key.

The main menu items give further access to sub menus and parameter settings.

Parameter settings are usually presented to the right, but may also be listed in an overlay window.







Unit settings presented in the window's right column



Language settings presented in an overlay window.

The keys are used as follows to navigate in the menu system:

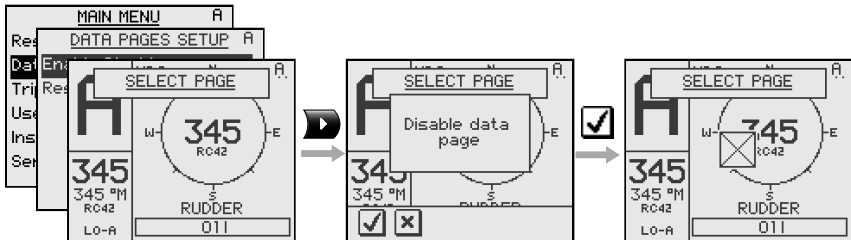
KEY	SINGLE PRESS	PRESS AND HOLD
	Confirm a selection/parameter setting	
	Go to next menu level/parameter settings	
	Go to previous menu level/parameter listing	Return to active mode display
	Go to previous/next menu item, increase/decrease parameter value	

## 2.1 Data pages setup

All available data pages are enabled as default. See page 43. If you prefer to have less data pages available, pages may be disabled.



## Disabling pages



Continue to select pages and repeat the procedure if more pages are to be disabled.

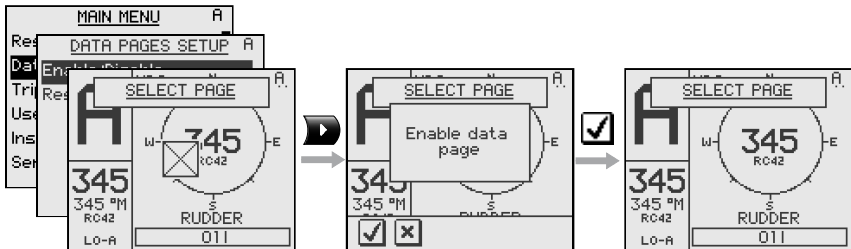
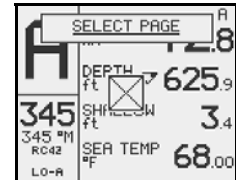


Press and hold the **Left** key to leave the menu and return to last active page.

## Enabling pages



*A disabled page is only visible when using the Enable/disable command. A disabled page is indicated with a crossed rectangle.*



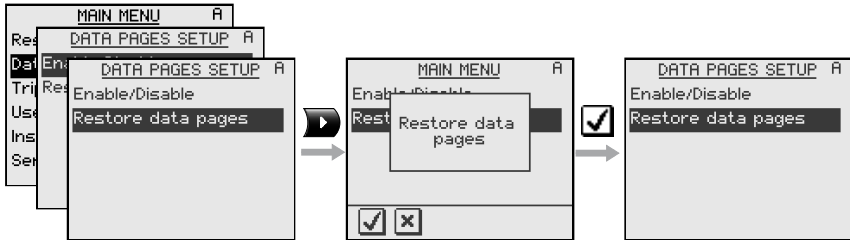
Continue to select pages and repeat the procedure if more pages are to be enabled.



Press and hold the **Left** key to leave the menu and return to last active page.

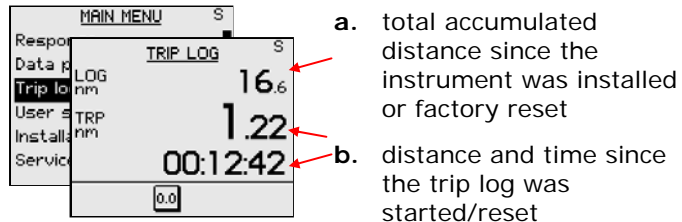
## Restore all pages

To restore all disabled data pages, select *Restore data pages*:



## 2.2 Trip log

The trip log display shows:



## Resetting the trip log



The trip log is reset to zero by pressing the **Reset** soft key.

## 2.3 User setup menu

The User setup menu contains items that the user may want to use on a less regular basis.

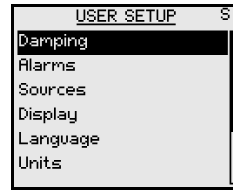
The following items are described:

- Changing the damping factors
- Alarm setup
- Automatic and manual source selection
- Changing the display settings

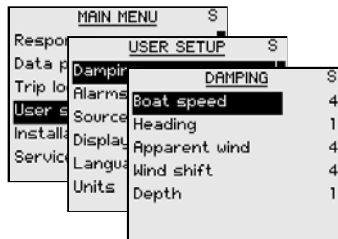
- Language selection
- Setting the units of measure
- Adjusting the seastate filter
- Changing the sailing parameters



*In this section it is assumed that the user is familiar with how to use the keys and how to maneuver in the menus. If not, refer to Main menu, page 45 onwards.*



## Damping



The damping factor indicates how fast the display will respond to changes.

The higher the damping factor the more stable display reading on the instrument.

Damping of the apparent wind angle is made by the Advanced Wind Filter (AWF) in the Autopilot Computer.

Increasing the 'Wind damping', will make the AWF output depend more on heading and boat speed. Decreasing the 'Wind damping', will make the AWF depend more on the "raw" apparent wind angle data.

The speed input to the AWF is Speed Over Ground (SOG). If SOG is not available, the AWF will use speed through

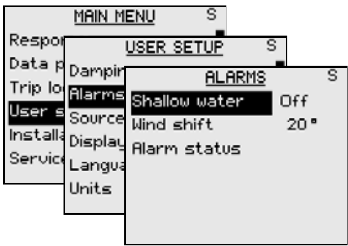
water. If none of these are available, the AWF will use a boat speed that is 1.5 times the Transition Speed.

Setting	Range	Change per step	Default
Boat speed	0 - 9	1	4
Heading			1
Apparent wind			4
Wind shift			4
Depth			1

Alarms

The AP28 may be set up to sound an alarm if vessel or environmental parameters exceeds preferred values.

The alarm monitoring is disabled by setting the value to **Off**.



Shallow water

The setting of the alarm is global and can be made on any Simrad unit that has this function implemented.

Range	Change per step	Default	Units
Off – 320 ft	1.6 – 5: 0.1 ft	Off	ft, m
	5 – 10: 0.5 ft		
	10 – 50: 1 ft		
	50 – 100: 5 ft		
	100 – 320: 10 ft		
(Off – 100 m)	(0.5 – 5: 0.1 m)		
	(5 – 10: 0.5 m)		
	(10 – 50: 1 m)		
	(50 – 100: 5 m)		

## Wind shift

*(Only available in Wind/Wind<sub>NAV</sub> mode)*

The wind shift alarm monitors the wind angle. The reference angle is set when the alarm is turned on and when the product is turned on. The reference wind angle is reset to present wind angle when the commanded (set) wind angle is changed on the autopilot and when a wind shift alarm is acknowledged.



*The wind shift reading is presented on the 'Wind shift'-data page and shows the change of wind angle with reference to the (geographic) wind direction.*

Range	Change per step	Default
Off, 5-90°	1	20°

## Alarm status

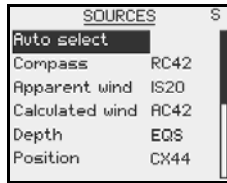
Displays a list of present alarms

## Sources

A data source can be a sensor or a device connected to SimNet providing data to other SimNet devices. Data can be of different type such as compass data, apparent wind data, calculated wind data, depth data, etc. A given data type will only be provided from one device to the other devices organized in a SimNet Source group (Ref. *Installation/ SimNet groups, page 94*).

At the first time turn on of a group of SimNet interconnected products (SimNet Source Group), data sources are automatically selected from an internal SimNet priority list. If a data source is connected to SimNet after the first time turn on, this will be identified and automatically selected if no other data source already is selected for the given data type.

It is only required to update the SimNet source selections if an alternative source is made available for a given data type and this source has not been selected automatically.



The data types and their respective data sources used in the products are listed on the source page in the products.

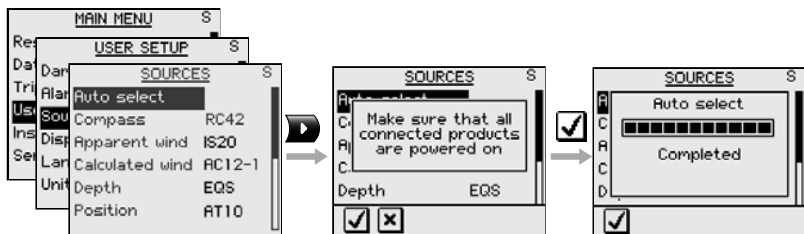
If no selection is made for a data type, '- - -' is displayed instead of the device name or acronym.



*SimNet will automatically select Position source and Navigation source from the same GPS/Chart plotter. If you want them to be different you have to change them manually.*


### Automatic source update

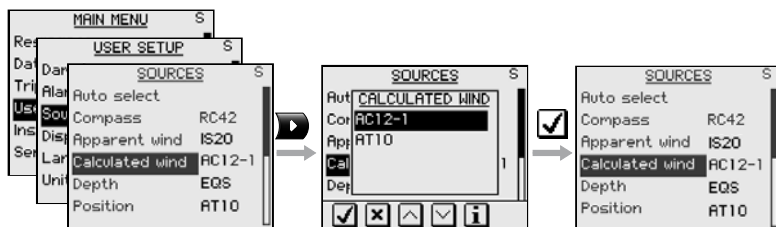
The **Auto select** function is mainly for situations where the automatic source selection needs to be updated because a selected data source is not supplying data or has been physically replaced with another one. The update secures that the existing source selections are valid and maintained. Missing sources are either automatically exchanged with an alternative source from the list of available sources for the given data type or the replacing source is selected. If a source is no longer available for the given data type, the display will show '- - -' instead of the source acronym.



If more than one source is found for each data type, the preferred source may be manually selected.

## Manual source selection

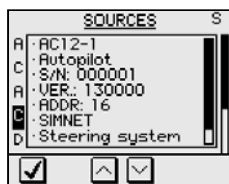
Data sources can also be selected manually. All devices providing data of the given type will be listed in a device list. Highlight the data type and press the  key to display the list of available devices.



Confirm selection of the highlighted device.



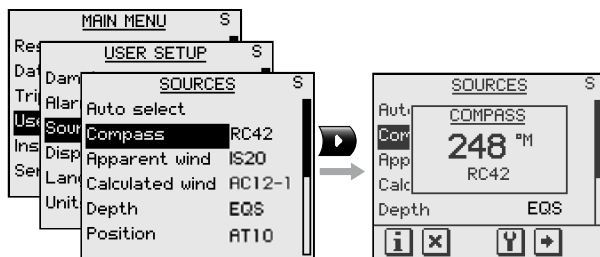
Exit without selecting

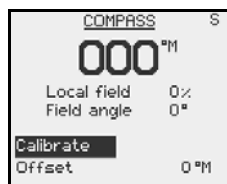


See information about the selected data source.



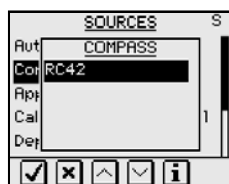
*For data types which can be calibrated, an overlay screen displaying the data from the selected data source will appear first (Ref. Installation/Calibration).*





Enter the Calibrate and Offset menu.



(Ref. Installation/Calibration).



Proceed to display a list of available sources for the given data type.

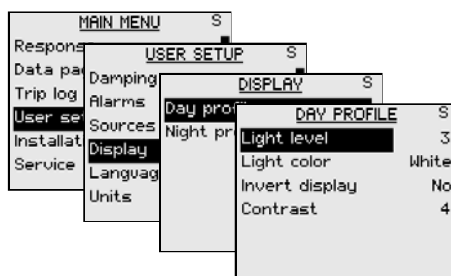
## Display

The display is controlled by the **Contrast** setting and two user profiles that can be individually adjusted.

The profiles are **Day profile** and **Night profile**. The profiles can be optimized for readability under different light conditions, and you can quickly switch between the two using the **PWR** key and the   softkeys. Refer to Backlighting, page 9.

For each profile you can:

- Adjust light level
- Select white or red light color
- Invert the display
- Adjust contrast



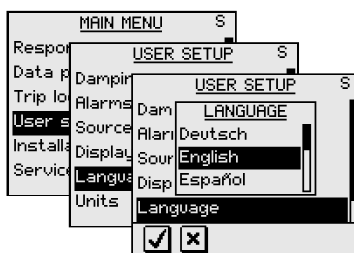


Setting	Range	Change per step	Default
Light level	Off – 9	1	3
Light color	White/red	-	White (Day) Red (Night)
Invert display	Yes/No	-	No
Contrast	0 - 9	1	4

## Language

The language is set when the autopilot is turned on for the first time. Refer *First time turn on*, page 63.

It is however possible to change the language at any time.



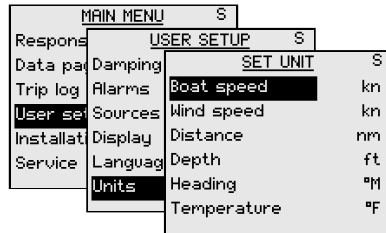
The following languages may be selected:

- Deutsch (German)
- English (English)
- Español (Spanish)
- Français (French)
- Italiano (Italian)
- Nederlands (Dutch)
- Norsk (Norwegian)
- Svenska (Swedish)

The language names are listed alphabetically in their own language.

Default language: English

## Units of measure



Parameter	Options	Default
Boat speed	<ul style="list-style-type: none"> <li>– kn</li> <li>– km/h</li> <li>– mph</li> </ul>	kn
Wind speed	<ul style="list-style-type: none"> <li>– kn</li> <li>– m/s</li> <li>– mph</li> </ul>	kn
Distance	<ul style="list-style-type: none"> <li>– nm</li> <li>– km</li> <li>– mi</li> </ul>	nm
Depth	<ul style="list-style-type: none"> <li>– m</li> <li>– ft</li> </ul>	ft
Heading	<ul style="list-style-type: none"> <li>– °M</li> <li>– °T</li> </ul>	°M
Temperature	<ul style="list-style-type: none"> <li>– °C</li> <li>– °F</li> </ul>	°F

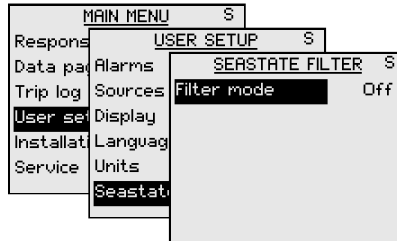


*The display unit for heading data is not solely determined by the user. If true heading is wanted but the selected compass is a magnetic compass, then the magnetic variation must be available from a position- or navigation source. The same applies if the user wants to read magnetic heading but receives true heading from the compass.*

*If magnetic variation is required but not available, the compass decides which unit to display.*

## Seastate filter

The Seastate filter is used to reduce rudder activity and autopilot sensitivity in rough weather.

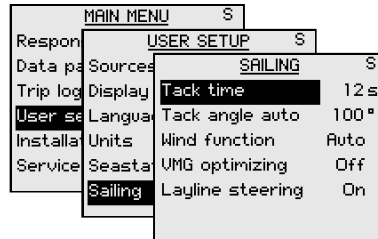


- OFF:** Seastate filter is disabled. This is default.
- AUTO:** Reduces rudder activity and autopilot sensitivity in rough weather by an adaptive process. The AUTO setting is recommended if you want to use the seastate filter.
- MANUAL:** Linked to the *Response* control setting in the *Main menu*. It may be used to manually find the optimum combination of course keeping and low rudder activity in rough but steady sea conditions.

## Sailing



'Sailing' is only available in the menu if 'Boat type' is set to 'Sail' in the Installation menu (see page 65).



The 'Sailing' screen can also be reached from the Wind mode main screen by pressing the **Menu** key followed by the **Wind** key within 2 seconds.

### Tack time

When performing a tack in WIND mode, the rate of turn (tack time) can be adjusted. This will give single-handed sailors time to handle the boat and the sails during a tack.

A turn performed without shifting wind side, will also be made at a controlled turn rate.

Range	Change per step	Default	Units
2 - 50	1	12	second

### Tack angle AUTO

In AUTO mode the set tack angle replaces a similar change of the set course using the starboard and port keys.

Range	Change per step	Default	Units
50 - 150	1	100	°

### ***Wind function***

With 'Wind function' set to 'Auto', the autopilot will automatically select between apparent and true wind steering. 'Auto' is default and recommended for cruising.

When the boat is running, it will also be surfing on the waves. This may lead to significant changes in boat speed, hence changes in apparent wind angle. True wind steering is therefore used when running, while steering to apparent wind is used when beating or reaching.

'Apparent' wind steering is preferred when you want to achieve maximum boat speed. The autopilot tries to maintain a constant apparent wind angle to get maximum thrust from a given trim of the sails.

When sailing in closed waters, the apparent wind angle may change temporarily due to wind gusts. It may then be preferred to sail to the true wind; select 'True'.

Range	Default
Auto – Apparent - True	Auto

### ***VMG optimizing***

Optimizing the VMG to wind will be active for 5–10 minutes after a new wind angle has been set and only when beating.

'VMG' will be displayed below the mode index when the VMG optimizing feature is active.

Range	Default
Off - On	Off



### ***Layline steering***

Layline steering is useful when navigating. Cross Track Error (XTE) from the navigator will keep the boat on the track line. If the XTE from the navigator exceeds 0.15 nm, the autopilot will calculate the layline and track towards the waypoint.

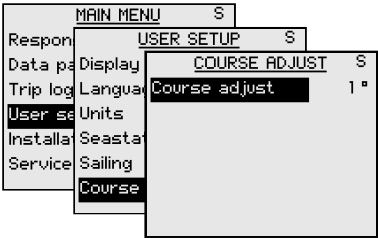
'XTE' will be displayed below the mode index when layline steering is active (page 40).

Range	Default
On - Off	On

*Course Adjust*

When using the  (PORT) or  (STBD) keys in AUTO mode, you are changing the set course in 1° increments.

Select 10° if you want to make major course changes in 10° increments with the keys and fine-tune the set course with the course knob (does not apply for sailboats).



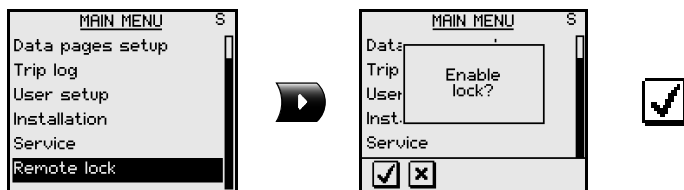
Range	Default	Units
1 and 10	1	°

**2.4 Remote lock**

The "Remote lock" function is a safety feature included in the AP28 system. It will disable all other control units.

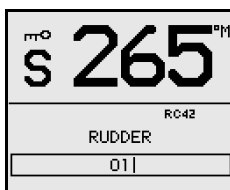
When the "Remote lock" function is in use, no transfer of command can take place; only the active control unit stays in command.

The "Remote lock" function is enabled as follows:



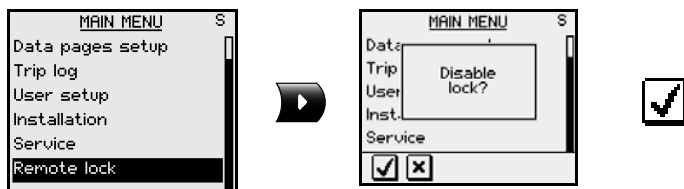
On the active control unit a **Om** icon will alternate with the mode index.

The "locked" control units in the system will show:



The Lock function is disengaged by one of the following actions:

- The active control unit unlocks the other ones and makes them inactive:



- The system is switched OFF by any control unit (press **PWR** key for 2-3 seconds).

***Blank page***



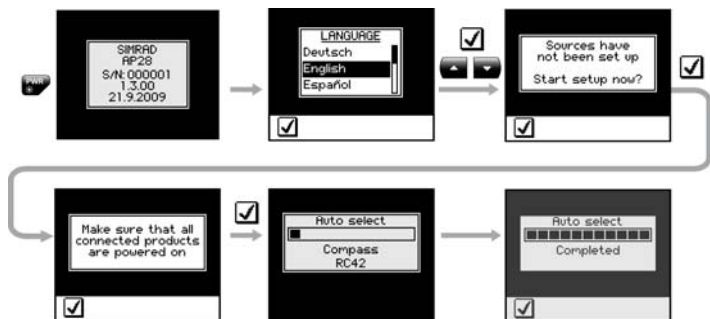
## 3 Setup at installation

### 3.1 First time turn on


Before attempting to turn on the AP28 and perform an Installation Setup, the hardware installation and electrical connections must be completed in accordance with the installation instructions.

When the AP28 is powered on for the first time, the instrument will run through an automatic start-up sequence presenting:

- Product name, software version, release date
- Language selection
- Automatic data source selection



The display will show which items of the installation setup that needs to be done and those already done.

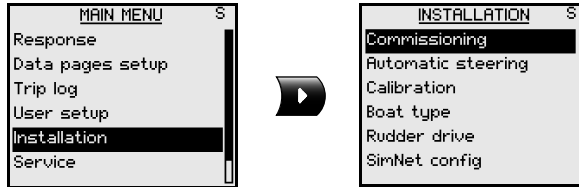
Press the  softkey to continue with the installation setup according to the next chapters.

## 3.2 Installation Menu



*The installation settings must be performed as part of the commissioning of the AP28 system. Failure to do so correctly may prohibit the AP28 from functioning properly!*

The Installation menu can only be accessed in STBY mode.



The Installation settings are grouped into the following functional categories:

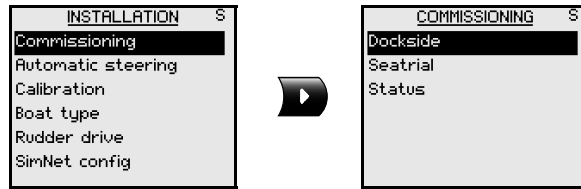
- Commissioning: Dockside and Seatrial setup
- Automatic steering: Permits viewing and changing of basic steering parameters (See also response control on page 15)
- Calibration: Calibration of sensors (also partly part of Commissioning)
- Boat type: Select boat type (also part of commissioning)
- Rudder drive: Rudder drive setup (also part of commissioning)
- SimNet config: SimNet group setup

Each group is designed to focus on specific functions and enable quick access when changes need to be made.

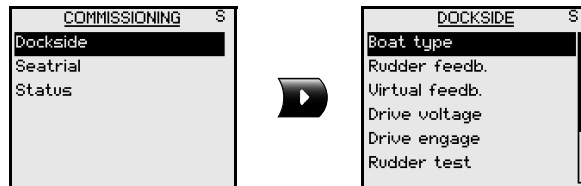
Some important points regarding the installation settings:

- When the AP28 is delivered from factory AND ANY TIME AFTER AN AUTOPILOT RESET HAS BEEN PERFORMED, the installation settings are all reset to factory preset (default) values. The automatic interface prompt will appear (see page 63) and a complete setup has to be made
- The Seatrial settings are dependent on successful completion of the Dockside settings

## Commissioning



### *Dockside settings*



*If the autopilot has no rudder feedback unit installed refer to Virtual Rudder Feedback on page 74-77.*

The following menu items are accessible and can be set up in the Dockside menu:

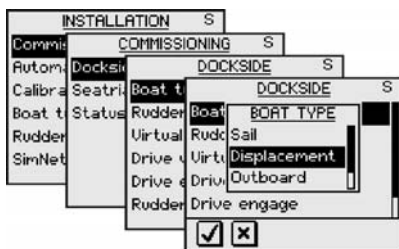
- Boat type
  - Rudder feedback
  - Virtual feedback
  - Drive voltage
  - Drive engage
  - Rudder test
  - Depth calibration
  - Minimum wind angle
  - Nav change limit
- } Not applicable for EVC!  
(ref. page 115)


### **Boat type**

Type of boat selected will affect the steering parameters, and the functions available in the autopilot system.

The options are: Sail, Displacement, Outboard and Planing.

Select appropriate *Boat type* by using the **Up** and **Down** keys.

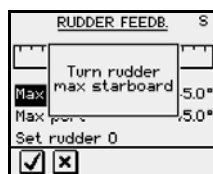
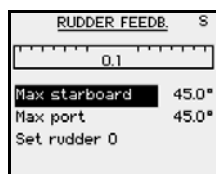


Confirm by pressing the  softkey.

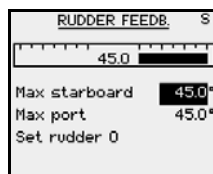
### Rudder feedback calibration (Not applicable for EVC)

Make sure the unit is installed and aligned as per instruction in the AC12/42 Installation manual.

The rudder feedback calibration will set the correct relationship between the physical rudder movement and the rudder angle readout.

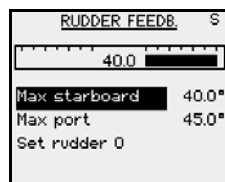
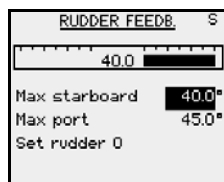


Manually turn the helm/wheel to starboard until the rudder stops at starboard lock (H.O.).

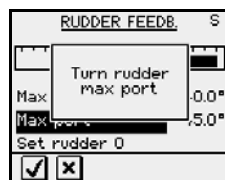
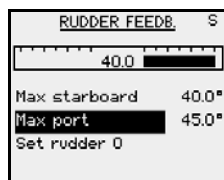


The Max starboard angle is the angle read by the rudder feedback unit before any adjustment is made.

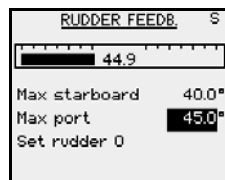
If the actual rudder angle is different from that of the display, correct the reading with the **Up/Down** keys (see note next page).



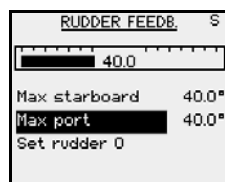
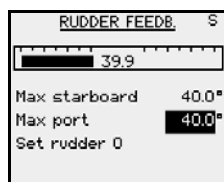
Confirm Rudder feedback calibration to starboard by pressing the **MENU** key.



Manually turn the helm/wheel to port until the rudder stops at port lock (H.O.).



Adjust the displayed angle the same way as for starboard rudder.



Confirm Rudder feedback calibration to port by pressing the **MENU** key.



*Many boats have  $\pm 45^\circ$  ( $90^\circ$  H.O. - H.O.) rudder angle as standard. So if you are not going to make any adjustment to the displayed angle you should still highlight the reading and confirm. This is necessary to prevent the rudder from hitting the end stops.*

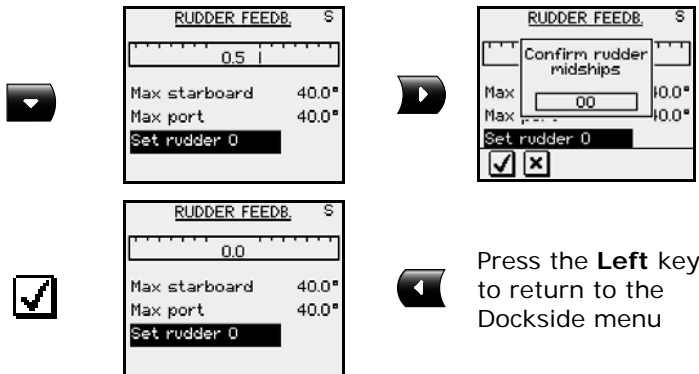
Rudder zero may still be inaccurate and should be adjusted under the next menu item.

## Special test of LF3000/LFI 3000 Mk2 feedback

- 1 Align engines to center position; "zero rudder".
- 2 Rev engines to 3-4000 rev/min and observe the rudder angle indicator on the autopilot, a 2° change in the reading should be accepted.
- 3 If the rudder angle exceeds 2°, connect the screen on the TB1 cable (LFI3000) to the center block terminal and repeat item 2 (Refer to the AC12/AC42 Installation manual). If this gives a better result keep the screen connected.

## Set Rudder 0 (zero) (Not applicable for EVC)

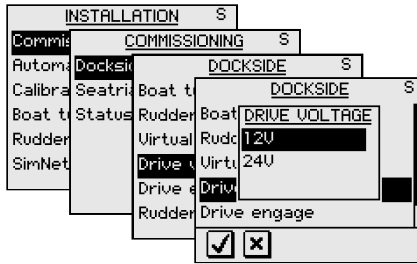
Bring the rudder to midship position and confirm. This will adjust an incorrect reading caused by misalignment of the rudder feedback unit.



## Drive voltage

Set the drive voltage to the correct level. The selections are 12V or 24V, and should be set to the voltage specified for your drive unit.

Refer to the drive unit table in the AC12/AC42 Installation manual for information.



The drive engage/bypass clutch output follows the same voltage as set for the drive unit. It is not possible to select a higher voltage than the supply voltage.



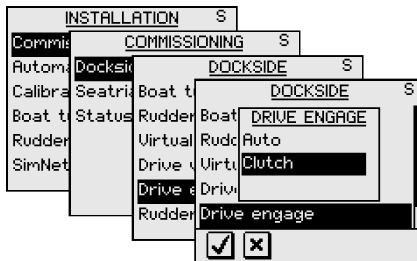
***Selection of improper voltage level for your drive unit may damage both the drive unit and the autopilot computer even if the protection circuits in the autopilot computer are activated.***



*The drive unit voltage setting does not apply when operating solenoids on a continuous running pump. Hence, the voltage to the solenoids will be the same as the supply voltage.*

During the Rudder Test, the AP28 system will automatically detect whether the drive unit is a reversible motor or a solenoid valve is operated.

### **Drive engage (Not applicable for EVC)**



Drive engage has the following settings: *Auto and Clutch.*

### Clutch:

This is the default setting and it allows you to steer the boat with the helm or wheel when in STBY mode. The 'Drive engage' port will activate (go high) in all active steering modes, and typically engage a bypass valve on a hydraulic linear drive or a clutch on a mechanical drive.

### Auto:

This setting is implemented for future use. Always use the "Clutch" (default) setting.

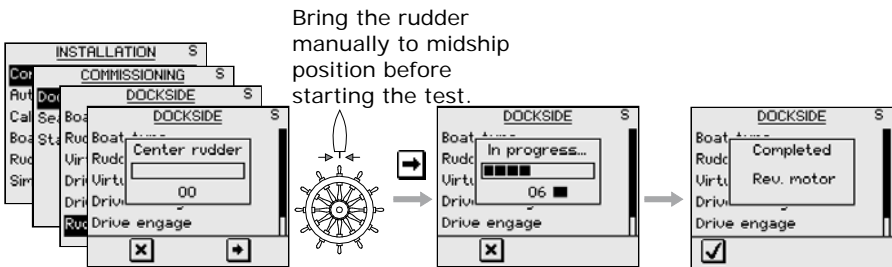
### Rudder Test (Not applicable for EVC)



*If the boat uses power assisted steering, it is important that the engine or electric motor used to enable the power assist steering be turned on prior to this test.*



**Stand CLEAR of the wheel and do not attempt to take manual control of the wheel during this test!**



The Autopilot Computer will after a few seconds issue a series of PORT and STBD rudder commands and automatically verify correct rudder direction. It detects minimum power to drive the rudder and reduces the rudder speed if it exceeds the maximum preferred speed (8°/sec.) for autopilot operation.

The **Rudder test** is verified by the display showing 'Completed Rev. motor', 'Completed solenoids', or 'Failed'. If 'Failed' is given, check for correct electrical connection.

Also refer to "Alarms" beginning on page 105.

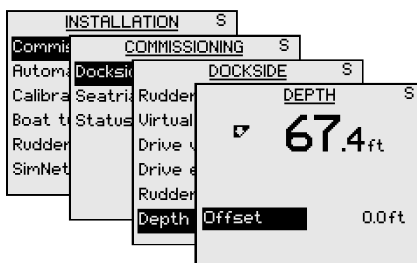


## Depth calibration



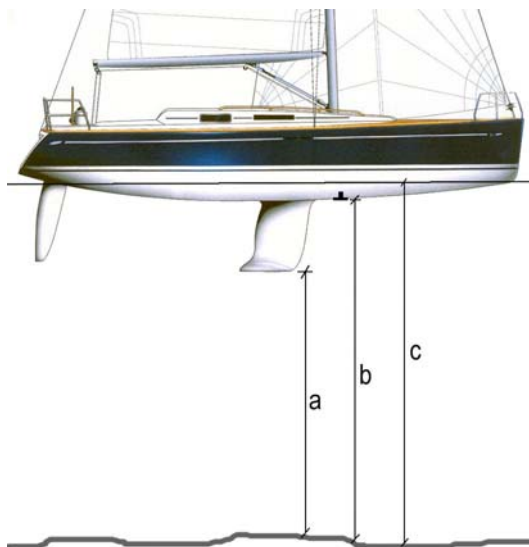
*This adjustment only applies to “smart” depth transducers that outputs depth on NMEA2000 format.*

The default value for the depth offset is 0.0, which indicates the displayed depth from the transducer to the seabed (b). Refer to the illustration on next page.



The value should be increased or decreased, depending on whether the depth reading should be from the water line or from the keel respectively:

- A negative offset equal to the vertical distance from the transducer to the keel will display the depth as measured from the keel (a)
- A positive offset equal to the vertical distance from the transducer to the water line will display the depth as measured from the water line (c)

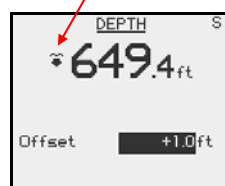
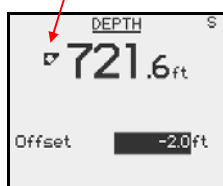


The symbol in front of the depth reading will change to indicate that the depth is measured from:

the keel

or

the water line

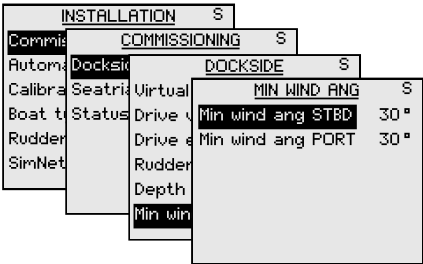


Range	Step	Default value	Units
-10 - +10	0 - ±5: 0.1 5 - 10: 0.5	0.0	m, ft

Press the **MENU** key to confirm the offset setting.

### Minimum wind angle

Wind steering is only available if 'Boat type' is set to 'Sail' in the Installation menu.



The 'Minimum wind angle' is the minimum apparent wind angle that will keep the sails well shaped and give an acceptable thrust. This parameter will vary from boat to boat.

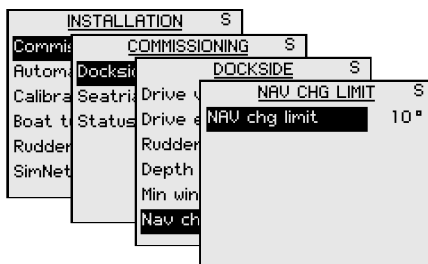
The 'Minimum wind angle' applies for the tack-prevent function. It also applies when the autopilot is operating in Wind<sub>NAV</sub> mode.

You can select different minimum wind angles for port and starboard. The difference between port and starboard will be taken into account when calculating the Distance To Turn (DTT).

Range	Change per step	Default	Units
15 - 90	1	30	°

### Nav change limit

In NAV mode, when the required course change to next waypoint in a route is more than the set limit, you are prompted to verify that the upcoming course change is acceptable. The limit is adjustable.



The 'Nav change limit' screen can also be reached from the Nav mode main screen by pressing the **MENU** key followed by the **NAV** key within 2 seconds.

Range	Change per step	Default	Units
10 - 30	10	10	°

### ***Dockside settings when using Virtual Rudder Feedback***

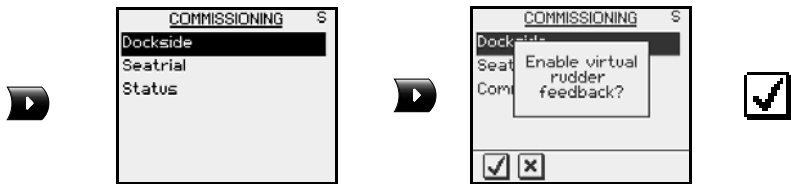
The Virtual Feedback algorithms in the autopilot software enable your autopilot to steer without a conventional rudder feedback unit. These algorithms are designed for vessels up to 40 ft. powered by outboard or stern drives only.


Installing a feedback unit, however, will enhance the performance of an autopilot and provide an accurate rudder angle indicator on the autopilot display. Unless impractical or impossible, a rudder feedback unit should be installed.



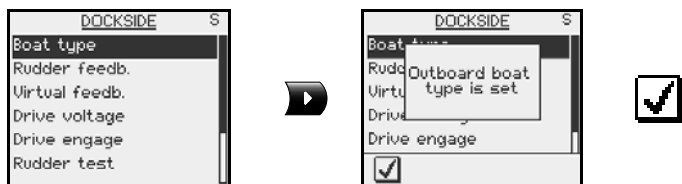
The autopilot is configured for Virtual Feedback when there is no feedback unit connected at first time turn on, and at turn on after an Autopilot reset has been performed (Page 104).





Select "Dockside" menu and press the  softkey to confirm.

### Boat type



When the autopilot is configured for Virtual Feedback the *Boat type* is automatically set to *Outboard*.

### Rudder Feedback (calibration) (Not applicable for VRF)

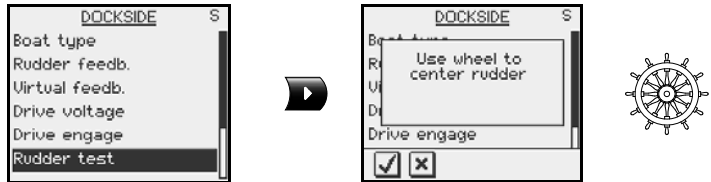
(Default values  $\pm 35^\circ$  are used)


Refer to pages 68-69 to set the Drive unit voltage and the Drive Engage.

## Rudder test

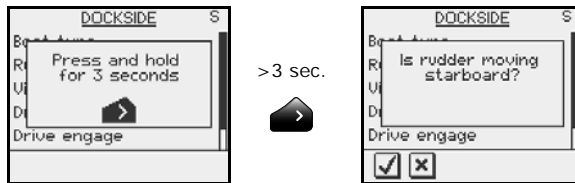
To perform the Virtual Feedback rudder test you must be able to view the movement of the engines/drives ("rudder").


Activate the automatic rudder test as shown, following the instructions on the display.




Confirm by pressing the  softkey.

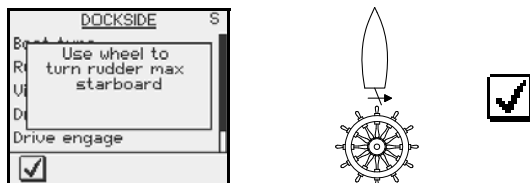
The next step is to enter the correct direction of the rudder movement.




If the rudder is not moving so as to give a starboard turn, press the  softkey, and repeat.

When the rudder starts to move to starboard release and press the  softkey to confirm.


Continue to follow the instructions on the display.

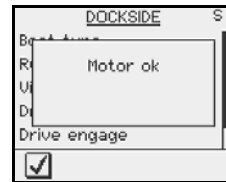
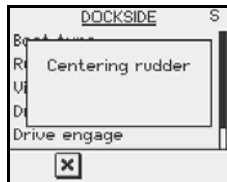


With the rudder hard over to starboard, turn the wheel carefully a little to port to release the hydraulic pressure.

Confirm by pressing the  softkey.



Proceed as per display instructions and immediately release the  key when the rudder reaches the port hard over position. The rudder will now be automatically centered.



The **Rudder test** is verified by the display showing 'Motor OK' or 'Failed'. If 'Failed' is given, check for correct electrical connection.

Also refer to *Alarms* beginning on page 105.

## Seatrial settings

The Seatrial menu presents settings and automatic calibrations to be performed during seatrial.

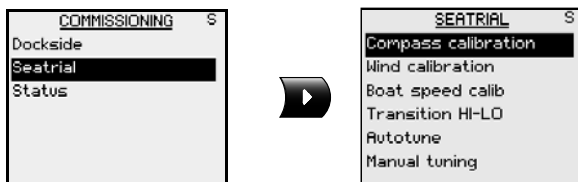


***The seatrial must always be performed in open waters at a safe distance from other traffic.***

The *Seatrial menu* can only be accessed if the Dockside Settings are completed and confirmed.

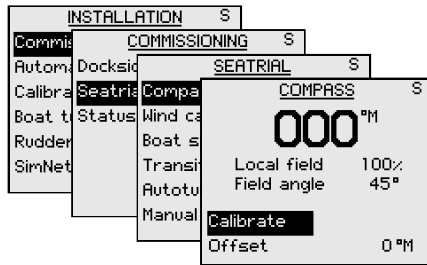
The seatrial settings are:

- Compass calibration (To automatically compensate for on-board magnetic interference and to compensate for a fixed offset (A-error) in the final heading readout)
- Wind calibration (To compensate for a fixed mechanical offset of the Wind vane)
- Boat speed calibration
- Transition speed (the speed at which you want to change the set of steering parameters)
- Automatic tuning (A method of determining the steering parameters)





## Compass calibration



Before the compass calibration is started, make sure that there is enough open water around the vessel to make a full turn.

The calibration should be done in calm sea conditions and with minimal wind to obtain good results. Use about 60-90 seconds to make a full circle.

1. Highlight the **Calibrate** line in the dialog
2. Begin turning the boat to port or starboard
3. Press the **MENU** key to start the automatic compass calibration



- a. An information window will be displayed when the calibration procedure is running.
- b. The digits below the bargraph will read **0.0** when the turn rate is correct. Too high or too low turn rate is indicated as follows (For RC42 Rate Compass only!):



*Turn rate too high,  
turning cw*



*Turn rate too low,  
turning cw*

4. The automatic calibration is completed when the information window disappears from the display

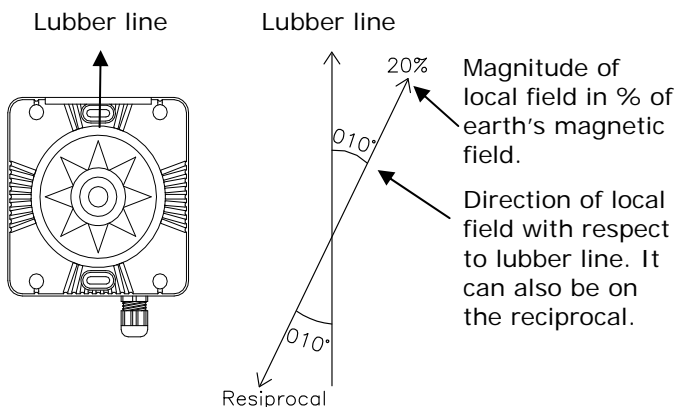


*The FC40 and RC42 compasses will store the calibration and offset data in their own memory.*

During the calibration, the compass will measure the magnitude and direction of the local magnetic field. If the local magnetic field is stronger than the earth's magnetic field (the local field is reading more than 100%), the compass calibration will fail. If the local field is reading more than 30%, you should look for any interfering magnetic objects and remove them, or you should move the compass to a different location. The (local) field angle will guide you to the local interfering magnetic object. See illustration next page.



- 1** *Calibration is made on the compass that is active for the autopilot.*
- 2** *If another model compass from Simrad or another manufacturer is installed, refer to the instruction for that compass regarding calibration.*



*In certain areas and at high latitudes the local magnetic interference becomes more significant and heading errors exceeding  $\pm 3^\circ$  may have to be accepted.*

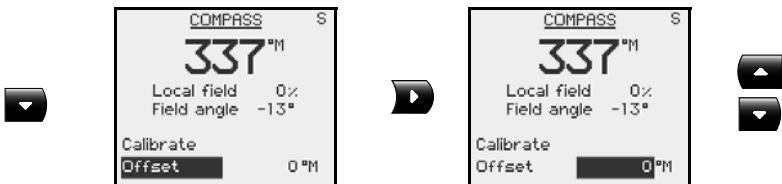
## Mounting Offset

After compass calibration, the difference between the compass lubber line and the boat's center line should be compensated for.

- 1 Find the bearing from the boat position to a visible object. Use a chart or a chart plotter
- 2 Steer the boat so that the center line of the boat is aligned with the bearing line pointing towards the object
- 3 Change the offset parameter so that the bearing to the object and the compass readout becomes equal



*Make sure that both the compass heading and the bearing to the object have the same unit ( $^{\circ}M$  or  $^{\circ}T$ ).*



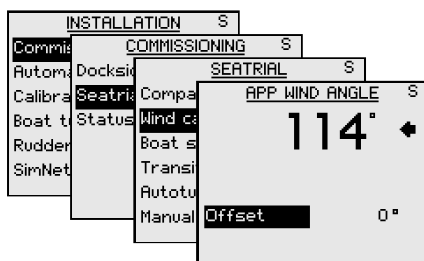
- 4 Confirm the Offset by pressing the **MENU** key

## Wind Calibration



*This calibration only applies if you have a wind transducer directly connected to SimNet (IS12TW) or a wind transducer that outputs data on NMEA2000 format.*

Any residual error in the apparent wind angle display can be corrected manually by entering the required offset.



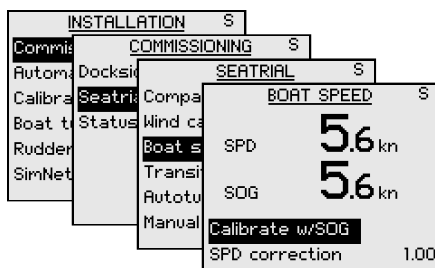
A positive value indicates starboard offset angle, - a negative value indicates port offset angle.

Range	Change per step	Default	Units
-180 - +180	1	0	°

Press the **MENU** key to confirm the offset setting.

## Boat speed calibration

The hull shape or the location of the speed sensor may cause incorrect speed readings, and it may be required to calibrate the input to ensure that correct speed and log values are displayed.



## Calibrate by Speed Over Ground

With a GPS connected to the system, the speed through water (SPD) can be calibrated equal to Speed Over Ground. This adjustment should be made in calm sea with as little wind or tidal current as possible.

- 1 Bring the boat up to a constant cruising speed (above 5 knots)
- 2 Select **Calibrate w/SOG** and press the **MENU** key
- 3 Press the **MENU** key again to confirm and execute the calibration
- 4 The SPD Correction factor will now be changed to equal the SOG and SPD values

## Manually adjust the speed value

If you experience an incorrect speed reading, this can be manually re-adjusted by running the boat at constant speed over a known distance in both directions and average the speed reading. This reduces the effect of wind and tidal current.

Then adjust the **SPD Correction** factor to get the correct speed reading.

Range	Change per step	Default
0.50 – 1.50	0.01	1.00

## Transition HI-LO

The *Transition HI-LO* is the speed at which the AP28 will automatically change the steering parameter set from HI to LO parameters, or vice versa (page 13).

The default setting of the *Transition speed* is 6 knots.

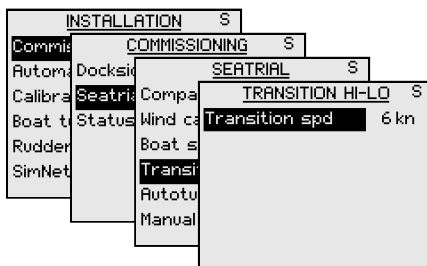
On power boats it is recommended that you set the *Transition HI-LO* to a speed that represents the speed where the hull begins to plane or the speed where you change from slow to cruising speed.

On sailboats the transition speed should be set to 3-4 knots to give the best response in a tack.

The speed used for the automatic transition is obtained with the following priority:

- 1 Speed through water from the speed log source
- 2 Speed Over Ground (SOG) from the GPS/chart plotter

See also page 13.



Range	Change per step	Default	Units
OFF - 30	1	6	knots

## Automatic tuning

*Autotune* is a feature that automatically sets the most important steering parameters (*Rudder* and *Counter Rudder*) by taking the boat through a number of S-turns. The scaling factors of the parameters are also set automatically as a function of the boat type selection performed in the Dockside menu.

The automatic tuning process is also verifying/adjusting the "Rudder zero" alignment made in Dockside setup.

Automatic tuning is a procedure that is **not** required for the AP28 to function as it is preset with steering parameters that should steer most boats in the 30-50 foot range.



*Recommended speed during Automatic tuning should not exceed 10 knots. It should be performed in calm or moderate sea conditions, preferably when steering East or West.*

For displacement boats use a speed that is approximately half the normal cruising speed (i.e. if cruising speed is 10 knots, perform the *Autotune* at about 5 knots).

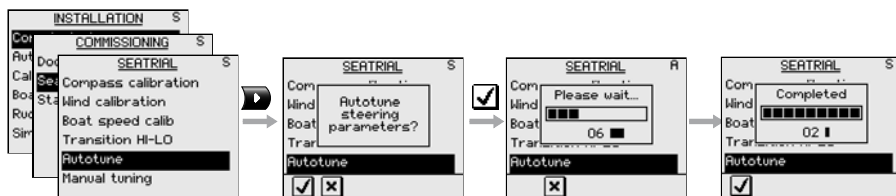
The parameter values calculated during *Autotune* becomes the HI parameters. The LO parameters are automatically set to 66% of the HI.



*After the Autotune has been completed the rudder must be controlled manually, as the autopilot has returned to STBY mode.*



***The Automatic tuning function will take control of the boat and perform a number of S-turns. It must always be performed in open waters at a safe distance from other traffic. The Automatic tuning function may take from 2 to 3 minutes to complete. To stop the Autotune, press the STBY key.***

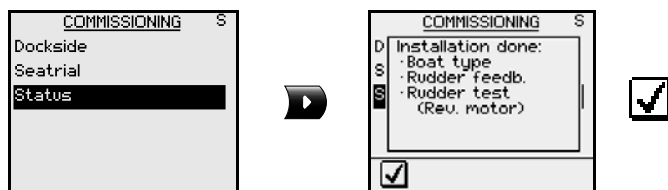


Activate the *Autotune* by pressing the softkey.

After an *Autotune*, there should be no need for further adjustments. Fine tuning of these parameters are made by the response control (see page 15). However, viewing or changing the parameters can be made in AUTO mode by entering 'Installation' in the Main Menu. See also "Recall Autotuned" below.

### Status

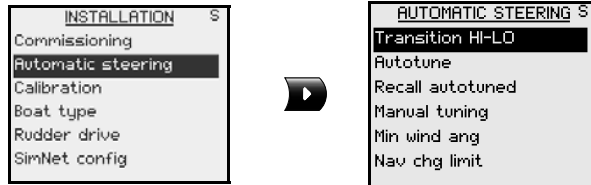
The Status screen shows a list of installation items to be done and installation items completed.



Return to the Installation menu item 'Automatic steering' if you want to adjust the steering parameters. See below for information.

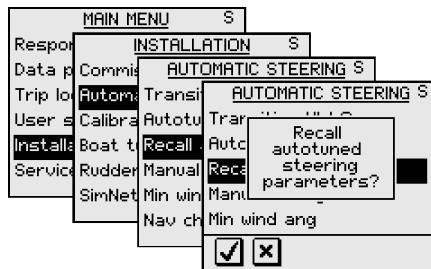
## Automatic steering

The Automatic steering menu contains steering parameters for course steering, wind steering and nav steering.



### Recall autotuned

To recall the parameter values that were achieved during the *Autotune* procedure, select *Recall autotuned* under 'Automatic Steering', and press the key.



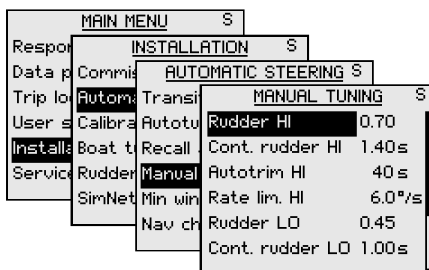
Confirm by pressing the softkey.

### Manual tuning


The steering parameters can be looked at and changed if needed under this menu item. The parameters are divided into two sets (page 17):

- HI value parameters for automatic steering at low speed and when running with a sailboat
- LO value parameters for automatic steering at high speed and when sailing into the wind or reaching with a sailboat





The 'Manual tuning' screen can also be reached from the Auto mode main screen by pressing the **MENU** key followed by the **AUTO** key within 2 seconds.

Confirm by pressing the  softkey.

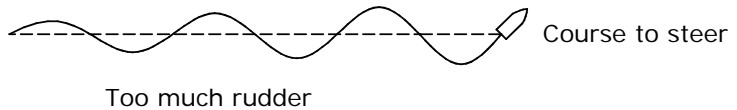
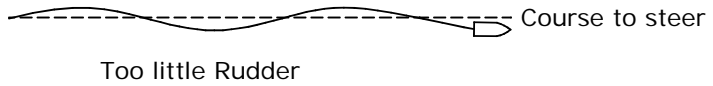
Displayed parameter	Boat type		Own boat	
	Displacem. & Sail	Planing & Outboard	Autotune	Manual
Rudder HI	0.50	0.30		
Cont.Rudder HI	1.40	1.40		
Autotrim HI	40 sec.	40 sec.		
Rate Lim HI	6.0°	6.0°		
Rudder LO	0.35	0.20		
Cont.Rudder LO	1.00	1.00		
Autotrim LO	40 sec.	40 sec.		
Rate Lim LO	6.0°	6.0°		
Minimum rudder	Off	Off		



The values in the table are factory set (default) and listed for information only. After having performed the Autotune, the values may differ from those listed in the table. See also "Autotune" previously in this chapter.

The two most important parameters that determine the performance of the automatic steering are *Rudder* and *Counter Rudder*.

**Rudder** sets the rudder gain which is the ratio between the commanded angle and the heading error.



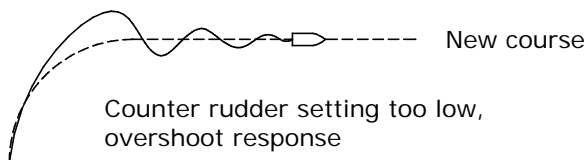
- Too little Rudder and the autopilot fails to keep a steady course
- Too much Rudder gives unstable steering and reduces speed
- Low speed requires more rudder than high speed

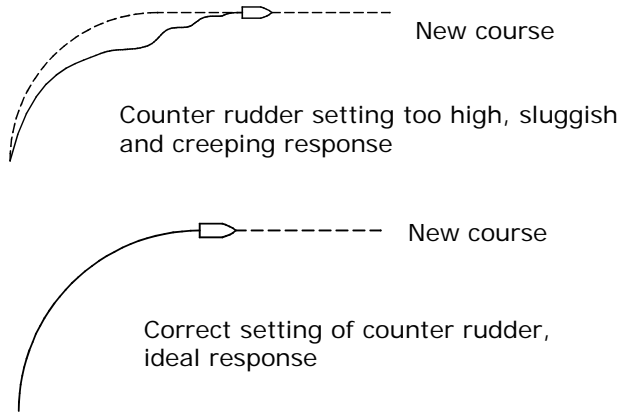


*See also "Minimum Rudder" on page 89.*

**Counter Rudder** is the parameter that counteracts the effect of the boat's turn rate and inertia. For a short time period it is superimposed on the proportional rudder response caused by the heading error. It may sometimes appear as if it tends to make the rudder move to the wrong side (counter rudder).

The best way of checking the value of the Counter Rudder setting is when making turns. The figures illustrate the effects of various Counter Rudder settings.





**Autotrim** standard value is 40 seconds which should work well on most boats.

Rule of thumb: Set to same value (seconds) as the boat's length in feet.



*On boats operating on VRF it should be set to 20 seconds*

**Rate Limit** should be kept at 6.0°/second unless there is a need for more rapid response in turns.

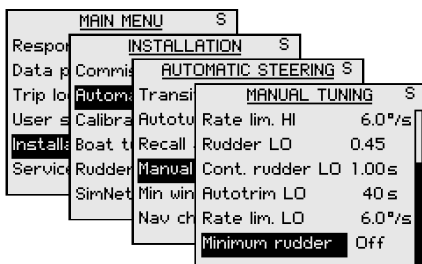
### **Minimum rudder**

Some boats may have a tendency of not responding to small rudder commands around the "course keeping" position because of a small rudder, a rudder deadband, whirls/disturbance of the water-stream passing the rudder or it is a single nozzle water jet boat.

Turning the Minimum Rudder function 'On', may improve the course keeping performance on some boats, but will increase the rudder activity.



*During the seatrial, only set Minimum Rudder to ON if it proves to give a better course keeping performance in calm sea. It should be set after the Autotune has been performed and a possible fine tune of the Rudder parameter (page 88).*



Range	Change per step	Default	Units
OFF - 5	0.1	OFF	°

## Final seatrial

After having completed all settings in the Installation Menu, take the boat out and perform a final seatrial in open waters at a safe distance from other traffic.

- Steer the boat on all cardinal headings in AUTO mode
- Start with low and medium speeds to get familiar with the response from the AP28
- Verify the HI/LO transition and the effect of LO and HI parameter settings (page 13)
- Try the effect of the Response adjust (page 15)
- Try the U-turn function
- If a Non Follow-up lever (or handheld remote) is connected, test change of modes and verify port and starboard steering commands of the lever
- Set waypoints into each navigator connected to the system, and verify that the AP28 steers in NAV mode for each NAV source
- Try the NoDrift mode
- If the boat is a sailboat use the WIND mode and try the AP28 at different settings of the apparent wind angle. Also try the WINDN(av) mode, optimized VMG and WCV when sailing (tacking) to a waypoint
- If the rudder response feels aggressive during the seatrial, you may want to reduce the rudder speed to

get a smoother steering. Alternatively on a sailboat you may want to have a higher rudder speed when running

- The motor Drive out (page 92) can be set with the above in mind. Never adjust in more than 10% steps with respect to the reading set during the automatic rudder test (page 70). Always perform a new Autotune after the adjustment
- Provide the owner with user training

### **Providing user training**

The user should be instructed in the "basic" operational functions, such as:

- Turning the system on and off
- Changing modes. Explain briefly what takes place in the different modes
- Regaining manual control from any mode. Point out in what modes the helm is engaged by the autopilot
- Taking command at an "inactive" station, if applicable
- Using the lock mode, how to lock/unlock and how to shut the system down from a locked control unit, if applicable
- Use of the Power steering mode (NFU)
- Use of a Non Follow-up controller, if connected
- Changing course by rotary knob and keys
- Stepping through the Main menu and sub menus learning how to (and why to) change the settings
- How to select alternative sources for heading (compass), navigation (GPS), chart plotter, speed, depth etc. if available
- Understand the difference between NAV mode and NoDrift mode and their data sources (Nav, Pos)
- Locating compasses and knowing to keep magnetic items away
- Locating the Mains circuit breaker and the separate SimNet circuit breaker if provided

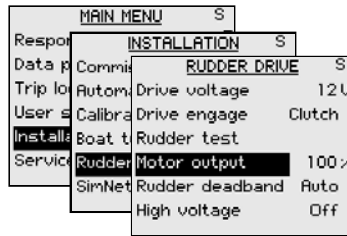
## Calibration

The Calibration is another entry to procedures for calibrating the compass, rudder feedback, depth, apparent wind angle and boat speed. These procedures are covered under 'Commissioning'.

## Rudder drive

The sub-menu items linked under 'Rudder drive' are part of the commissioning except for *Motor output*, *Rudder deadband* and *High voltage*.

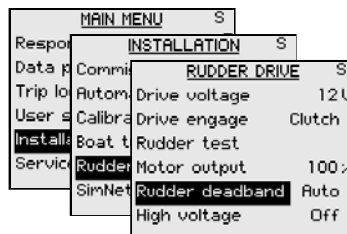
### Motor output



The *Motor output* (displayed in percentage) is the amount of maximum available power needed to achieve correct rudder speed on automatic steering (Maximum speed is used in NFU mode). This setting will allow you to adjust the rudder speed to be different from the one automatically set in the rudder test.

### Rudder deadband

The rudder deadband function is adaptive and is continuously operative. It prevents the rudder from hunting and the adaptive function optimizes the deadband to the speed of the boat and the pressure on the rudder.



If the auto-setting does not perform properly due to high inertia from the wheel or a loose steering gear, it can be adjusted manually.

Find the lowest possible value that will prevent the rudder from continuous hunting. A wide deadband will cause inaccurate steering. It is recommended to check rudder stability in AUTO mode when the boat is moving to get pressure on the rudder.

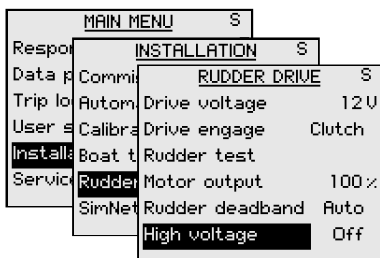
Range	Change per step	Default	Units
AUTO, 0.1 – 4.0	0.1	AUTO	°



*The rudder deadband setting is not available when the autopilot is configured for Virtual feedback.*

### High voltage rudder drive setting

A special High voltage setting accommodates drives with high stiction (static friction) and higher rudder pressures, as the boat speed increases.



When you set a voltage level, the proportional output will be disabled and the motor will be driven by on-off commands similar to solenoid operation. The voltage can be adjusted in 1V steps. If set to maximum voltage (12V / 24V) it will read *Solenoids*.

The High voltage can also be set in the VRF rudder test after centering the rudder.

## SimNet configuration

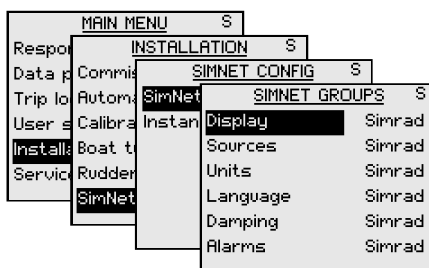
SimNet units can be assigned in groups and given an instance number for identification.



### SimNet Groups

The SimNet group function is used to globally control parameter settings in groups of units. The function is used on larger vessels where several units are connected via the SimNet network.

By assigning several units to the same group, a parameter update on one unit will have the same effect on the rest of the group members.

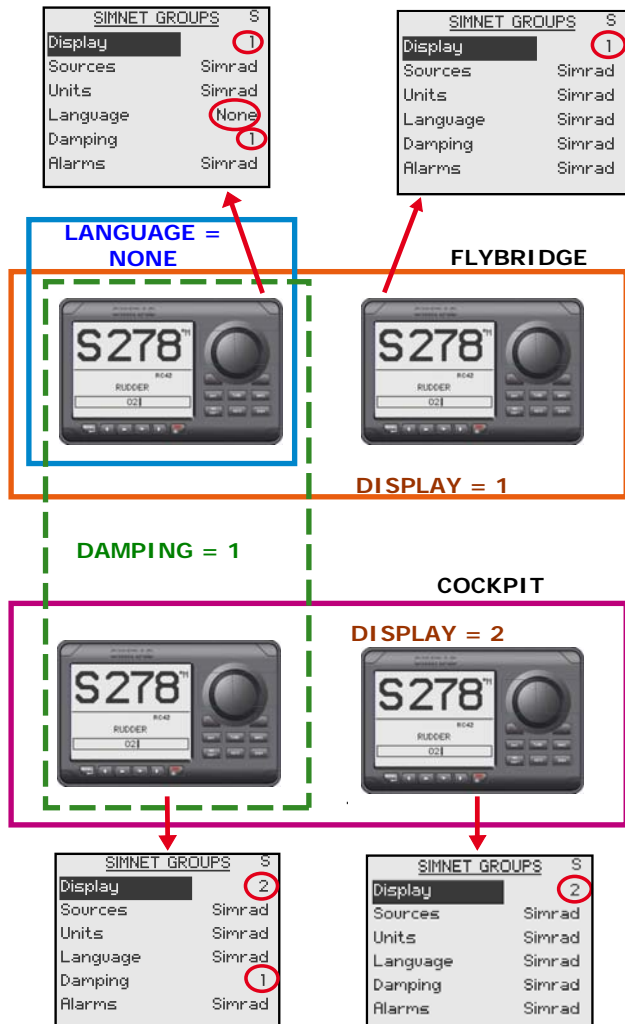


Setting	Range	Default value
Display	Simrad, None, 1-6	Simrad
Sources	Simrad, None	Simrad
Units	Simrad, None, 1-6	Simrad
Language	Simrad, None, 1-6	Simrad
Damping	Simrad, None, 1-6	Simrad
Alarms	Simrad, None, 1-6	Simrad



- Simrad: Default group for AP28
- None: Not assigned to a group
- 1 – 6: Group numbers

The figures below illustrate how the instruments on a flybridge and in a cockpit are assigned to separate language, damping and backlight groups, and how this affects the setup for the different instruments.



*Instance number*

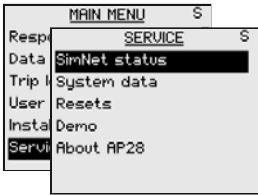
The instance number is used to identify multiple units of the same model when connected to a SimNet or NMEA2000 network. The instance number is added to the product name e.g. AP28-1, AP28-2 for easy identification of the unit.



Range	Step	Default value
0 - 20	1	0

**3.3 Service Information**

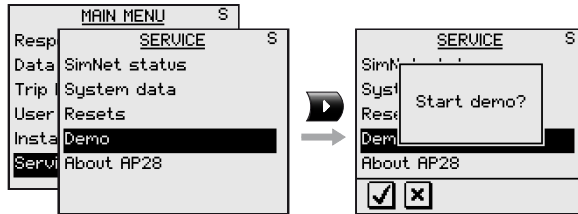
Also see Troubleshooting page 103 about SimNet status, System data and resets.



The main menu includes a Service item that access several options to display data used when testing or troubleshooting the system.

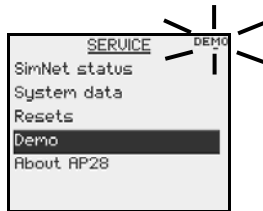
**Demo**

The autopilot includes a demo mode useful for demonstration and on show. All data displayed in the data pages can be simulated.



Confirm Demo mode by pressing the ☒ softkey. If the unit is turned off while in demo mode, the demo mode will still be active on next power on.

Demo mode is deactivated by using the menu as illustrated above. An automatic source update is then initialized.



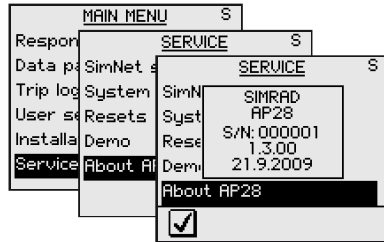
The user will be notified with a 'DEMO' message every 1 second as long as the demo is running.



*To have the full benefit of the autopilot in Demo mode, an Autopilot Computer must be part of the system.*

## About

By selecting the **About** menu item, an information window will display autopilot model, serial number, software version number (1.3.), software release (00) and date of release.



*The shown readout is only an example!*

## 4 Alarm system

### 4.1 Alarm indication

The alarm system in the AP28 autopilot is activated if any alarm settings are exceeded. Refer to *Alarms*, page 50.



When an alarm is notified, the alarm will be indicated with an alarm text and with an audible alarm.

The different alarm indications are shown in the table below.

Alarm type	Sound	Light	Reminder interval
Vital alarm	Alternating between 2 tones	Switching on/off	10s
Important alarm			20s
Standard alarm			40s
Warning	Single beep		60s
Light warning	Single beep		

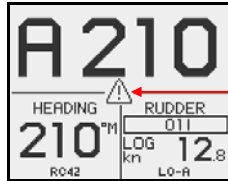


If AP28 is connected to other SimNet units, any alarm in the system will be displayed on the control unit.

If no specific alarm text is displayed, an alarm code will appear. Refer to *Alarm codes*, page 100.

## 4.2 Acknowledging an alarm

An alarm is acknowledged by pressing any key. This will remove the alarm notification (text, light and sound) from all units that belongs to the same alarm group. Refer to SimNet Groups, page 94.



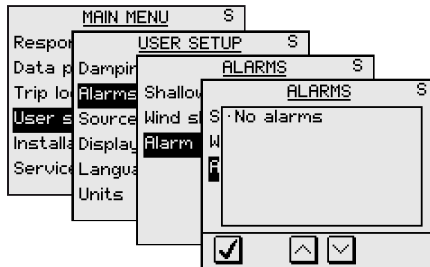
A reminder will reappear at given intervals as long as the alarm situation exists.



*An alarm received from other SimNet units must be rectified on the unit generating the alarm!*

## 4.3 Viewing active alarms

A list of any existing alarm condition may be displayed at any time.



## 4.4 Alarm codes

If the alarm text is received from other units connected to SimNet, the text will be displayed. If no text is received, an alarm code will appear.

A description for available codes are listed in the table on next page.

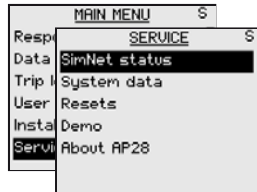
Alarm ID	Alarm
10	Shallow water
11	Deep water
12	Anchor alarm
13	Wind shift
14	True wind speed too high
15	True wind speed too low
16	Boat speed too low
17	Voltage too high
18	Voltage too low
19	Depth data missing
20	Wind data missing
21	Nav data missing
22	Compass data missing
23	Off course
24	Rudder data missing (RF25)
25	Rudder feedback failure (RF300)
26	Rudder response failure
27	Drive overload
28	High temperature
29	Bypass/clutch overload
30	Bypass/clutch disengaged
31	High drive supply
32	Low drive supply
33	No active control unit
34	No autopilot computer
35	ACXX Memory failure
36	No connection with EVC system
37	EVC override
56	RF must be calibrated

***Blank page***



## 5 Troubleshooting

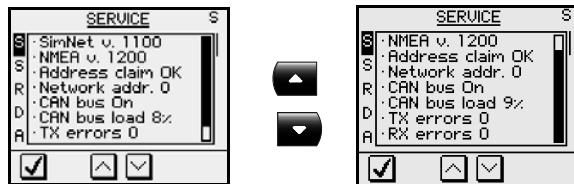
An autopilot is a complex system. Its performance depends on a proper installation and a successful seatrial.



The main menu includes a Service item that access several options to display data used when testing or troubleshooting the system.

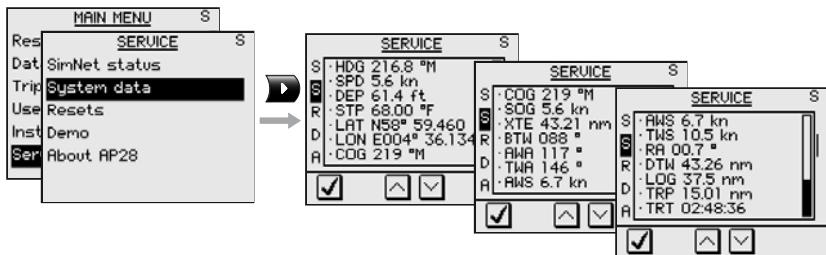
### 5.1 SimNet status

The SimNet status screen provides you with status information about the different SimNet messages used by the system.



### 5.2 System data

The System data screen provides you with status information about the different messages used by the system.

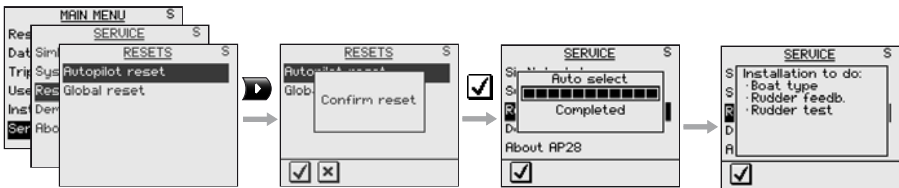


## 5.3 Resets

### Autopilot reset



*An Autopilot Reset is part of the final test at the factory, which will reset the memories to factory settings. Unless you need to clear all stored values during the installation setup, you should not perform an Autopilot reset.*



To confirm the autopilot reset press the softkey.

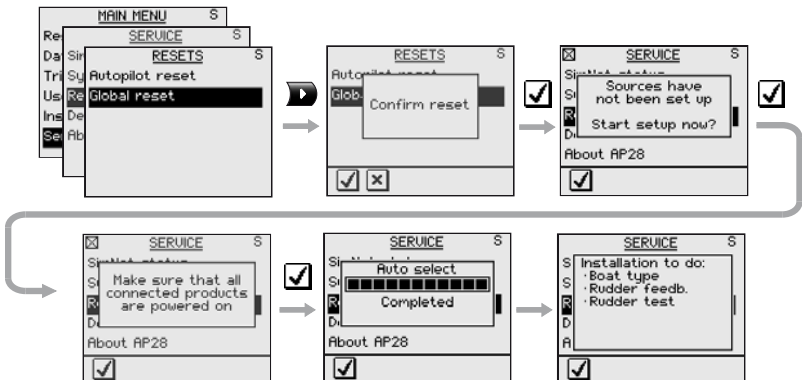



***The Installation and Setup procedures must be repeated after a reset has been performed!***

In the event an Autopilot reset has been made, refer to chapter 3.2.

### Global reset

A Global reset resets the entire SimNet setup in the Simrad Group and initiates a new automatic interface setup. See chapter 3.1.



To confirm the Global reset press the  softkey. The display will prompt you to repeat the interface setup.

### Autopilot failures

In the event of an autopilot failure, the AP28's numerous test features will assist you in isolating a probable fault.

Audible and visual alarm are provided for every fault being detected, see chapter 4.

Refer to the table below for hints and try to solve the problem yourself. You may also consult your nearest Simrad dealer for assistance, if required.

Perform any repair action in the listed sequence.



- 1     *The 'Off course' warning is automatically reset when the error is rectified.*
- 2     – – – *in a display indicates that data is missing.*

### 5.4 Alarms

Display readout	Probable fault	Recommended action
<b>System failure Alarms:</b>		
Off course	Boats heading is outside the fixed off course limit of 20 deg. (Automatic reset when inside limit). Extreme weather conditions, too slow speed	Check steering parameters (Rudder, Autotrim, Seastate-filter)  Increase Rudder value  Increase boat speed, if possible, or steer by hand
Nav data missing	Missing or invalid NAV data	Check the Nav. Receiver/GPS setup  See <i>Service menu</i> Chapter 3.3

Display readout	Probable fault	Recommended action
Shallow water	<p>The depth is inside the set limit or outside the range</p> <p>Depth data is missing</p>	<p>Carefully observe the actual depth</p> <p>Adjust the alarm limit if not hazardous</p> <p>Steer to safe depth, the alarm will reset automatically</p> <p>Turn off the shallow alarm if data is missing</p>
Compass data missing	No data from selected compass	<p>If more than one compass is connected to the system, refer to the <i>Setup/Sources</i> menu to select a different compass</p> <p>Make a source update if no compass is available</p> <p>Check connections</p> <p>Replace the compass (<i>Note: Do not cut cables. There are screw terminals inside</i>)</p>
Rudder data missing (not applicable for Virtual feedback installations)	RF25 Rudder feedback signal missing	<p>Check SimNet connections.</p> <p>Check the alignment as per the installation instructions</p> <p>Replace rudder feedback unit.</p>
Rudder Feedback failure (not applicable for Virtual feedback installations)	RF300 Rudder feedback signal missing or erratic	<p>Check all connections</p> <p>Check the alignment as per the installation instructions</p> <p>Replace the rudder feedback unit</p>
Rudder response failure	No response to rudder command	<p>Check all connections</p> <p>Check Rudder FB transmission link (not applicable for Virtual feedback installations)</p> <p>Check drive unit motor/brushes</p> <p>Replace the autopilot computer</p>

Display readout	Probable fault	Recommended action
Rudder test failed	Following conditions may exist:  Rudder feedback failure  Autopilot Computer current overload  Bypass/clutch overload	Refer to recommended actions for the specific probable faults
	Rudder moves in only one direction  Poor connection to one of the solenoids (continuously running pump)  Faulty PCB in autopilot computer	Check the connections  Replace the autopilot computer
	Rudder test not completed within 2 min.  Poor connections to the drive unit  Faulty PCB in the Autopilot Computer	Check connections  Check the PCB for traces of burned transistors. – Replace the autopilot computer
	Rudder moves at full speed to one side.  Faulty PCB in Autopilot Computer	Replace the autopilot computer
No active control unit	Active control unit goes silent	Press the STBY key on an "Inactive" unit to reset  Check/repair SimNet cable  Replace the control unit
Drive overload	The drive unit shut down due to an excessive load or a short circuit	Check the drive unit and drive unit installation. Look for mechanical obstructions. Check the manual steering  Disconnect the drive unit. If the fault is still present, replace the autopilot computer

Display readout	Probable fault	Recommended action
Bypass/clutch overload	Clutch/bypass current exceeds 3.3 Amps (overload or short circuit)	Check actual current Check voltage marking on coil Check coil resistance (through connecting wires)
Bypass/clutch disengaged	Poor connection or open circuit in bypass/clutch coil	Check connections Replace bypass/clutch if open Perform new "Rudder test"
ACXX High temperature	Excessive temperature in autopilot computer (>80°C), possible long term overload	Switch off autopilot Check for backload in Drive unit/steering system Check that the autopilot computer specifications matches Drive unit
ACXX Memory failure	Wrong checksum on memory parameters or variables. Autopilot computer will use default values	Perform a "Master reset" and make a new "Dockside set-up". Switch off and on again. If the alarm is repeated, replace autopilot computer
No Autopilot computer	Faulty autopilot computer or poor cable connections from the same	Check connectors and cable Replace autopilot computer
Low drive supply	Supply voltage less than 9 Volts	Switch autopilot off, charge batteries Check/repair battery charger
High drive supply	AC12/AC42 Supply exceeds 35 Volts	Switch the autopilot off Check/repair battery charger
Depth data missing	Missing or invalid depth data	Check depth sensor/cables
Wind data missing	Missing or invalid wind data	Check wind sensor/cables
Wind shift	Wind shift exceeds 'Wind shift limit'	Re-enter Wind mode to reset the Wind shift reading Expand limit Set wind shift limit to Off

## 6 Maintenance

### 6.1 General

The AP28 units are “repair by replacement” units, and the operator is therefore required to perform only a very limited amount of preventive maintenance.

### 6.2 Control unit

The AP28 Control Unit will under normal use require little maintenance.

If the unit requires any form of cleaning, use fresh water and a mild soap solution (not a detergent). It is important to avoid using chemical cleaners and hydrocarbons such as diesel, petrol etc.



Make sure that all open SimNet connectors are fitted with a blocking plug (part no 24006355).

It is advisable at the start of each season to check all connections to the control unit head and cover with Vaseline or WD40.

Always put on the weather cover when the unit is not in use.

### 6.3 Autopilot Computer

No special maintenance is required. It is advisable, however, at the start of each season to make a visual inspection of the internal and check all connections.

### 6.4 Rudder Feedback

Make a visual inspection at 2-3 month intervals and at the start of each season. Apply some grease at the ball joints when required (RF300, RF25)

## **6.5 Compass**

If the compass is exposed to the weather, make a visual inspection at 2-3 months intervals, and at the start of each season.

## **6.6 Drive unit**

Refer to the drive unit manual for maintenance instructions.

## **6.7 Exchange of software program**

Contact Simrad Customer Support about software updates.

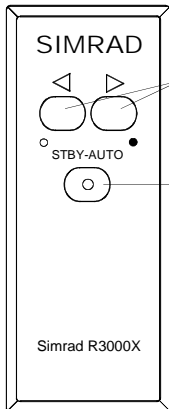


## 7 Optional equipment

### 7.1 R3000X Remote Control (NFU)

R3000X is a small handheld remote control with two keys for power steering or course selection (port and starboard), and one key with a LED indicator for (limited) mode change.

#### Operation




Push key for Port and Stbd commands

STBY/  
automatic.

Automatic modes are active when the lamp is lit.

In STANDBY mode, the rudder will move for as long as the Port or Stbd key is pressed.

In AUTO mode and Wind modes the set course or set wind angle will change 1° each time the key is pressed.

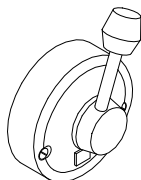
 If you keep the key pressed, it will automatically change the setting in increments of 3° per second.

Mode changes are as per table below.

- 1) *NAV and WIND<sub>NAV</sub> modes can only be entered from the Control unit because you have to accept their prompt displays.*

Initial mode	1 <sup>st</sup> press	2 <sup>nd</sup> press
STBY	AUTO	STBY
AUTO	STBY	AUTO
NODRIFT	STBY	NODRIFT
NAV	STBY	AUTO <sup>1)</sup>
WIND	STBY	WIND
WIND <sub>NAV</sub>	STBY	WIND <sup>1)</sup>

## 7.2 S35 Steering Lever (NFU)



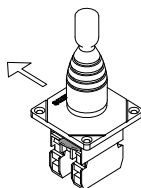
S35 has spring loaded return to mid-position. A push button with light indicator is used for mode selection similar to the R3000X Remote Control.

Alternatively S35 can be used as a conventional NFU lever without mode selection.

### Operation

Refer to the operation of the R3000X in the previous chapter. On S35 you move the lever to right or left instead of using keys.

## 7.3 JS10 Joystick (NFU)



The JS10 Joystick is a Non Follow-up steering lever designed for indoor and outdoor console mount. It has a spring-loaded return-to-mid-position and is equipped with 10 m (33') of cable and installation hardware.

### Operation

JS10 has no mode change feature. The rudder will move for as long as the lever is held in left (Port) or right (Starboard) position.

## 7.4 AP28 with MSD50 Stern Drive unit



*The information in this chapter only applies if your autopilot is driving a Simrad MSD50 Stern Drive.*

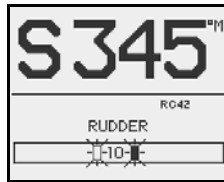
The MSD50 Stern drive needs a zero point setting after the autopilot has been turned on. Refer to the MSD50 manual for further information.

## Zero point setting



*Unless you need a rudder angle display when leaving the dock, just steer the boat manually on a straight course and press the **AUTO** key. The zero point is then set automatically.*

If you prefer to use the rudder angle display when leaving the dock, proceed as follows:



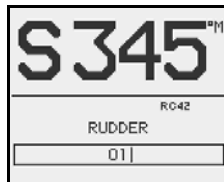
After turn-on the rudder angle display will alternate between 10 degrees port and starboard to indicate that the (rudder) zero point need be set.



Turn the wheel from lock to lock (H.O. to H.O.) and count the exact number of turns. Then start from one lock position and turn the half number of turns.



Press **AUTO** and then **STBY**. The zero point is now set and the display will show:



Return to the operation section. There is no further need for zero point settings until next time you turn the autopilot on.

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## 8 Glossary

**Apparent wind** – The speed and direction from which the wind appears to blow with reference to the bow when the boat is moving (also called relative wind).

**Arrival alarm** – An alarm signal issued by a GPS/chart plotter that indicates arrival at or at a predetermined distance from a waypoint (see arrival circle).

**Arrival circle** – An artificial boundary placed around the destination waypoint of the present navigation leg, the entering of which will signal an arrival alarm.

**Bearing** – The horizontal direction of one terrestrial point from another, expressed as the angular distance from a reference direction, usually measured from 000° at the reference direction clockwise through 359°.

**BTW** – Bearing to a specified waypoint from present position. The correct acronym for the more commonly used BPW (Bearing Position Waypoint).

**BWW – Bearing waypoint to waypoint** - Bearing angle of the line between the "TO" and the "FROM" waypoint, calculated at the "FROM" waypoint for any two arbitrary waypoints.

**COG - Course Over Ground** - The actual direction of progress of a vessel, between two points, with respect to the surface of the earth. The vessel's heading may differ from the course over ground due to the effects of wind, tide and currents.

**DCT – Depth Contour Tracking**

**EVC – Electronic Vessel Control** – enables boat's engine, transmission, instruments and control systems to communicate and exchange information via a common bus network. Through proper interface to EVC, an autopilot can get sensor data from the EVC, do steering calculations and send rudder commands back to the EVC which brings rudder to commanded angle.

**GPS - Global Positioning System** - This system is based on satellites in fixed orbits, circling the earth at an altitude of approximately 20,200 km. The system will provide the user with 24 hour a day all weather position coverage, with an accuracy of 5 to 30 meters.

**Magnetic bearing** – Bearing relative to magnetic north; compass bearing corrected for deviation.

**Magnetic deviation** – A local magnetic field on-board a vessel. Can interfere with the earth's magnetic field and create compass readings that may deviate from the actual magnetic heading. The deviation will vary with the actual heading.

**Magnetic heading** – heading relative to magnetic north.

**Magnetic variation** - A magnetic compass points to the magnetic north pole. The difference between this direction and true north is the magnetic variation. The amount and direction of this variation is dependent upon where on the earth you are located.

**NMEA0183** - A format (language) designed to permit communication between various types of marine electronic equipment. In essence this is a two-wire shielded, serial data link, permitting one device to talk while other devices listen. Numerous different sentences are available, permitting communication between various different devices.

**NMEA2000** – A modern serial-data communications network to interconnect marine electronic equipment on-board vessels. Equipment designed to this standard will have the ability to share data, including commands and status, with other compatible equipment over a single signalling channel.

**PGN** – An acronym for Parameter Group Number. PGNs are used in NMEA2000 analogues with the three capital letters used in NMEA0183 sentences, e.g. XTE.

**Product ID** – A number, suffix, acronym or term that can identify a product.

**Product name** – The name of a Simrad product known from sales and other literature.

**Route** - A stored sequence of waypoints. These waypoints will be listed in the order in which you desire to follow them.

**SimNet** – An acronym for Simrad Intelligent Marine Network based on the NMEA2000 communication protocols.

**SimNet Class 1 products** – Simrad products that are SimNet controllers, i.e. they have an appropriate display and routines that can set up and control the SimNet.

**SimNet Class 2 products** – Simrad products that do not contain a SimNet controller. When connected to SimNet they will automatically pick the first available source on SimNet and lock onto that. When a Class 1 product is added to the Simrad Group, Class 2 products will automatically subordinate themselves to the Class 1 source selection.

**SimNet Group** – A number of Simrad products that are selecting and sharing the same data sources via the SimNet network.

**SimNet Source** – Any product or device directly connected to SimNet or NMEA2000, or interfaced to SimNet via NMEA0183 or Robnet2.

**SOG** - Speed over ground is the actual speed of the vessel relative to the ocean floor.

**True bearing** – Bearing relative to true north; compass bearing corrected for compass error.

**True heading** – Heading relative to true north (the meridian).

**VMG** – Velocity Made Good. A vessel's true progress towards a waypoint taken into consideration all factors like leeway and current.

**Waypoint** - A discrete point, stored in a navigator, located on the surface of the earth. Normally this point will be identified by Lat/Lon coordinates although in some systems it may be shown by T.D.'s.

**XTE - Cross Track Error** - Used to identify a vessel's position relative to a straight line drawn between two waypoints. The amount the vessel is off to the left or to the right of this line is known as the Cross Track Error. It is normally displayed in thousands of a nautical mile, equal to 6 ft or 1.85 m.

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